

December 25, 1961

Aviation Week

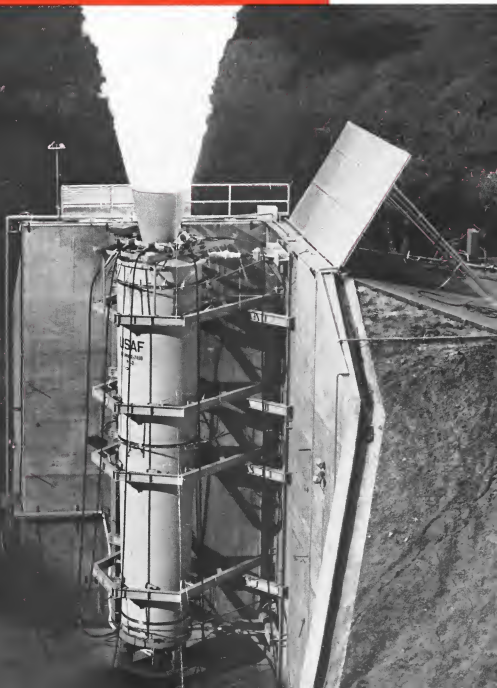
and Space Technology

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Laurels for 1961

As we predicted at the end of 1960 (AW Dec. 26, p. 11), the pace of the U.S. aerospace effort has accelerated perceptibly during this year and there is considerable evidence all along the line (although still not enough to offset the full potential of our national resources) of more aggressive and determined leadership and a willingness to run the race with whoever wants to challenge. Hopefully this pace will continue to accelerate during 1962 and the country will be well on its way to winning its margin of technical superiority in fields where it has been threatened, and removing the gap in the long-term chase of the Soviets in space.

Here are the individuals and organizations that we think contributed efforts of major significance during 1961 in the aerospace field.

- **Vice President Lyndon B. Johnson** for his interest in providing the U.S. space program with national priority and at last expressing this nation's determination to compete against all comers in space technology.

- **Alan Bond**, Civil Aeronautics Board chairman, for his leadership in establishing direct contact between the CAB and airline pilots in an effort to solve the acute economic problem now besetting the air transport industry.

- **Mrs. Constance Walk**, who at the age of 36 created the women's free ballooning cadet corps record from the Soviet Union with a 46 hr 5 min performance through a storm-torn night.

- **Bob Turner**, vice president of Eastern Air Lines, for his work in restoring the fading airline art of passenger service and establishing the Boston New York Washington connector shuttle service.

- **Personnel of the 199th Recovery Control Group of USAF Systems Command**, based at Hickam AFB, Hawaii, for their persistence in perfecting the aerial recovery technique for Discoverer space data capsules, resulting in four successful air catches that year, of which three were in their newly equipped Lockheed C-130B transports.

- **Edmund Cosentino**, Bonanza Air Lines president, for introducing a new concept of area economic fares that will have significant economic impact on the local service airline business.

- **William T. Piper, Jr.**, for his octogenarian determination to push his company into support of positive drug growth in the lower income brackets by producing the two-place Colt lightplane at a price well below normal profit margins in this field, and **Thomas F. Piper** who kept the project on the track through engineering into high volume production.

- **Dr. Edward Webb**, executive secretary of the National Aeronautics and Space Council, for his administrative and political expertise applied to the numerous and very different technical problems plaguing the national space program, and for his indefatigable effort to achieve high priority for the program at the top level of government.

- **Dr. C. H. Townes** of Harvard, **A. L. Schawlow** and **Ali Javan**, of Bell Telephone Laboratories and **T. H. Maiman** of Hughes Research Laboratories for their work in optical

masers (lasers), a fundamentally new type of device with important applications for space communications, guidance and missile weapons.

- **Eric F. McLeod** of Pan American World Airways and **J. R. (Ray) Utterstrom** of Boeing Co. for spearheading both organizations' programs for increasing the ability of jet transports by increasing their all-weather operational capabilities.

- **Vice Adm. Robert Bates Pine**, deputy chief of naval operations for air, for effective guidance of naval aviation into the era of Mach 2 cruise-launched operations and increasingly sophisticated anti-submarine warfare work, and his judicious and effective efforts to promote the cause of U.S. aviation in international circles.

- **Cletius Wood**, of NASA, for his tremendously effective multi-faceted effort in establishing the U.S. space program scope and achievements among the people and technocrats of Europe at the Paris Air Show.

- **Convair's B-58 Mach 2 bomber** for its persistent and effective penetration of the U.S. air defense system, pointing the way toward a vital strategic delivery capability that is being critically neglected in the Defense Department.

- **Leslie Barnes**, president of Allegheny Airlines, for his success in broadening the economic base of local service carrier operations and pioneering pioneering methods that will enable the acquisition of reliably routes from those that are economically sound.

- **Barney Schoenbach** and **Dick Baader** of Pratt & Whitney Aircraft for spearheading the effort to bring the J75 turbofan into operational use with the Boeing 707 and the Douglas DC-8 jet transports and the Boeing B-58H bomber, providing a new level of operational economy and power for the gas turbine engine.

- **Jackie Cochran** for her courageous dogged assault on world aeronautical records when she cut the time of the year with her performance in the Northrop T-38 Talon supersonic trainer.

- **Bob Gilbreth**, **Walt Williams** and **Max Faget** and their hard-working staff of the NASA Manned Spacecraft Flight Center for their courage and skill in carrying on the long term chase of the Soviet Union's manned space flight achievement with Project Mercury.

- **Dr. Maria Tappan** of NASA and **Dr. Francis Roddebeck** of the U.S. Weather Bureau for their leadership of the joint effort to develop an operational system for utilizing satellite-borne weather information.

- **North American Aviation's Rocketdyne Division** for its successful firing of the F-1 single chamber, million pound thrust rocket engine.

- **Wernher von Braun** and his Marshall Space Flight Center team for their persistence in making development of the Saturn space booster, powered by a cluster of eight Rocketdyne H-1 engines, to its first successful launch test at Cape Canaveral.

- **United Technology Corp.** and **Aerjet** for their successful firing of large solid rockets up to 500,000 lb thrust, demonstrating the feasibility of the large solid concept.

—Robert Holt



AERIAL MISSILE LAUNCHER. Photo shows Boeing B-52 nuclear bomber making in-flight launch of B-28 nuclear missile, which flies at supersonic speed toward target for about 10 minutes, variable B-52 can carry regular bomb by load of

gravity bombs. New B-52H, with turbofan engines and improved electronic systems, is tailored for wide variety of Strategic Air Command mission requirements. Later B-52H will carry hydrogen-fueled Skybolt ballistic missiles, a 1000 mile weapon under development.

Capability has many faces at Boeing



JET HYDROFOIL. Daring shows propulsion from hull jet hydrofoil during its design and testing for U.S. Navy Hydrofoil '69' on water speed trials at 112 mph.



TWIN TURBINE jetfighter. Boeing-T47B, seen 25 and will enter service next with New York Air Guard. T-47B has been ordered for service in Japan, Canada and Mexico. Military version is being built for U.S. Marine Corps.



SUPersonic JETLINER. Boeing continues to perfect technical data in supersonic jet transport research. During down line development time without development into world flights to three times speed of sound, make flight from New York to London in under three hours.

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Washington Roundup

Patent Storm Brews

The Administration has drafted a National Inventions Act that would establish reviewing new patent rights policies—all of which are subject to approval by the Senate. The plan is to submit it to Congress next month. The proposed law was considered among government agencies for comment last week by the Budget Bureau.

The act would require industry to share royalties with the government on all commercial licenses, require companies licensing after three years, with a limitation on the number of licenses, and give the government title to all patents unless the rights were waived by the holder of the department involved.

Export-Import Bank's new policy of guaranteeing private financing against political risk is expected to open new markets for utility airplane sales to underdeveloped countries.

Final Budget Tussle

There were indications last week that Budget Bureau Director David E. Bell was still opposing the \$2.5 billion increase in the proposed Fiscal 1963 defense budget last week. Bell cut the \$2.5 billion figure that Congress had approved. Whether the vote will prevail over that of the Defense Department depends at least partly on international political developments between now and the time the Administration's budget report is presented to Congress, which must be done within 15 days after Congress reconvenes on Jan. 10. Back of the budget document, which runs to the size of a metropolitan telephone book, had gone to the printer by last week, but some sections were being held over for last-minute changes. If the Administration should want to make further changes even after the document has been printed, it can do so in the form of altered priorities.

House Interstate and Foreign Commerce Committee, which was voted \$150,000 more than three months ago to study some substantial air airports, has yet to hire or assign a staff member to direct the investigation.

Black Lace Study

Ground effect machines equipped with helicopters or long-range weapons "may well have the greatest potential for reducing operating costs" for subsonic aircraft, according to a study known as Black Lace that was conducted for the U.S. Navy by Saunders-Roe Division of Britain's Westland Aircraft Ltd. Nine purposes of the study was to compare the operational potential of an outline vehicle with existing and projected anti-submarine craft of other types. Saunders-Roe officials recently briefed Navy leaders, including Vice Adm. John T. Hayward, deputy chief of naval operations for development, on their findings.

Proposals are now being put forward to build an SRN 3 as outline vehicle for the U.S. under mutual defense agreements. Negotiations have been off and on for some time. Saunders-Roe will test the SRN 2 next year (AW Dec. 11, p. 115).

Despite an acknowledged lead in rocket thrust, Soviet Russia has done comparatively little in the basic space sciences that will be the cornerstone of future space exploration, according to Dr. Robert Jarman, director of National Aeronautics and Space Administration's Goddard Institute for Space Studies. Dr. Jarman, who said the results of experiments in space at the Institute for Astronautical Sciences, 25th Wright Brothers Lecture, mentioned that U.S. scientists have published five times as much on scientific space findings as their Soviet counterparts. He also said the U.S. must develop a large new group of scientists to make use of the vast amount of new data that advanced scientific satellites such as the Orbiting Astronomical Observatory are expected to produce.

Secrecy on Sumos

Secrecy surrounding the Sumos reconnaissance satellite program for the past few months is the result of a policy that has the backing of the President himself. It is so strict that it forbids the use of the word Sumos by anyone directly connected with the project. Nevertheless, the telephone book for headquarters of the deputy commander for aerospace system of the Air Force Systems Command lists a Sumos project office with building, room numbers and telephone of key officials. The section of the Portuguese telephone book, dealing with the Air Force lists "Director of the Sumos Project." With a name, room number and telephone extension. Neither book lists an authorized security classification.

Federal Aviation Agency Administrator Nighth Hahley said shortly after he took office last winter that Washington's \$110 million Dulles International Airport terminal (see p. 30) was a "fugitive, long-range, headless, aimless, aimless" as he said about with the greatest degree of gloom and cynicism. Since then, a dramatic change has taken place in the development plan. Last week Hahley said the airport "is going to be a great innovation, it is going to work, and it is going to generate new business for the country" despite finding that it was expected to be more than double than now charged by Washington's National Airport. —Washington Staff

Joint Atomic Committee Planning Hearings on Radioactive Fallout

Washington—While the Atomic Energy Commission continues its evaluation of Russia's recent nuclear tests, Congress is laying the groundwork for the first hearings on radioactive fallout since 1979.

The upcoming Joint Congressional Atomic Energy Committee hearings, besides dealing with the extent and consequences of fallout, also will provide a forum for debating whether the U.S. should acquire nuclear tests in the atmosphere, having an earlier demonstration by President Kennedy. Hearing dates have not been set.

Chairman Chet Holifield (D-Calif.) is among those in Congress pressing President Kennedy to resume atmospheric testing. Rep. Holifield contends the U.S. cannot afford to risk falling behind the Russians in nuclear technology, and that atmospheric testing is essential to continued progress.

Propaganda Battle

President Kennedy apparently wants to delay acquisition of atmospheric testing as long as possible partly to emphasize that it was Russia—not the U.S.—which broke the nuclear-free zone has been trying to get out of the spotlight by pointing to the U.S. underground nuclear tests.

AEC Dec. 17 provided new Russian restrictions by announcing that a low yield nuclear test which was conducted at the Nevada test site. Soviet Ambassador Mikhail A. Menshikov is a television interview and if such news is not stopped at once, then of course we will start to see not only our own ordinary bombs, but perhaps super bombs also."

Foreign radio, in a broadcast in Yeghshen Dec. 14, and earlier U.S. charges that the Russian atmosphere test at Usty-Izhm had been conducted by the AEC (AW Dec. 13, p. 31). "Therefore," the broadcast said, "let us stop calculating the percentage of radioactive fallout and agree on general and total disarmament."

Fallout Debate

However, the fallout debate is increasingly fading. M. Deming, deputy director of AEC's division of environmental safety, last week and Russian nuclear tests over the years—not just the recent ones—have caused more fallout than those of the U.S. and United Kingdom combined. Deming and Russia's 1991 nuclear tests produced 120 megatons of total energy, while with 25 megatons of that total coming from Soviet Union products fell on its earth.

The extent of long-level radionuclides (cesium-90 and strontium-90) which fall on the U.S. from the Russian 1991 test will be equal to or a little more than that from all previous U.S. and U.K. tests, Deming said. He said Russia's tests will deposit 45 megatons of cesium-90 per square mile and 55 megatons of strontium-90 per square mile. The comparison with 40 and 70 megatons for those radionuclides deposited by U.S. and U.K. tests.

Counting the cesium-90 that may be deposited from all Russian tests, AEC estimated 90 megatons per square mile for cesium-90 and 100 megatons per square mile for strontium-90.

Witnesses are expected to debate the significance of these and other fallout figures at the congressional hearings. A related set of hearings also is planned for next year by the House Government Operations and Military Committee Subcommittee on civil defense against nuclear weapons. Rep. Holifield is chairman of that subcommittee.

French Cancel Plans For C-130 Purchase

Paris—French government has decided the Rafale program no longer requires the acquisition purchase of Lockheed C-130 Hercules transports for the French air force.

Last month, before his visit to Washington, French Defense Minister Pierre Mitterrand told the national assembly he was considering having U.S. leave transports to honor commitments on Rafale (AW Nov. 30, p. 24). Opposition is such purchase was strong from certain industry quarters. It was feared the purchase would cause French leave French aircraft programs currently under way.

When a supplementary budget bill was accepted and before the assembly, a government spokesman said the plan to buy four C-130 transports was abandoned. Instead, about \$7.1 million was put into a supplementary budget bill to speed strategic development of Nord Aviation Transall cargo transport, already being built jointly by France and West Germany.

The government spokesman admitted it would still be some time before Transall would be operational, but added that the supplementary budget no longer required emergency purchases of U.S. aircraft.

Other military items covered by the

supplementary budget bill include \$3.1 million additional credit for the French Navy's first helicopter carrier, La Bourdonnais.

Other items reflect drying up of U.S. military aid to French forces. One \$10 million item, for example, is for additional jet engines for the French Air Force's F-100s, originally given to FAF under the military assistance program. Another \$6.6 million item will finance a retrofit program for F-100s so the aircraft can be armed with nuclear weapons out of NATO's nuclear stockpile.

Proposals Are Due For NATO Strike Fighter

Paris—Design proposals for the North Atlantic Treaty Organization's sharply contested competition for a V/STOL strike fighter (transmutator fighter) are scheduled to be submitted here by late next week.

Although there have been persistent demands from some quarters that the specifications for the aircraft be revised, particularly from Germany (AW Oct. 21, p. 25), the latest revision apparently stipulate a maximum on the deck speed of Mach 92 for a distance of at least 250 m.

U.S. firms with recent proposals to fit NATO's Basic Military Requirements 2 include Lockheed Aircraft, with a V/STOL version of its Mach 2 F-105 in partnership with Britain's Short Brothers and Harland, and Republic Aviation Corp., with a variable sweep design in a consortium with British Siddeley, Pegasus, Fokker, Fokker-Wulf, France's Louis Breguet and SABCA and Avionics Finesse of Belgium. Bell Aerosystems also has assisted in the design of a German entry, the British Aerospace Hawk, and the French Dassault Mirage 3, and the Italian Aeritalia's Tornado.

In another move, Bell Aerosystems also has joined in an international industry group in a consortium plan designed to fulfill the NATO requirement for a supporting medium range V/STOL transport.

Initial design studies in the competition, designated RMR 4, were submitted in late November.

Collaboration agreement was signed by Bell with Hawker Siddeley, de Havilland of Canada, Avionics Finesse and France's Nord Aviation.

Design submitted to NATO by Hawker Siddeley before the November deadline include a Mk 2 version of de Havilland's Canby turbo-prop transport (AW Nov. 27, p. 31), possibly including incorporation of some 120 engines. Other U.S. firms with V/STOL transport proposals include Ling-Tecumseh-Vought and Douglas.



First photos show Dassault's Mirage 3. The French all-weather interceptors can also function as a ground support aircraft, a capability lacking in the production Mirage 3C. The Mirage 3B has a combat radius of 1,000 km and a strike radius of 1,000 km for the full 100 km strike radius. French is first place to follow production of second-hand Mirage 3Cs with the 3 version.

Close-Support, Photo Versions of Mirage 3 Tested



Mirage 3B reconnaissance model, of which two prototypes are being built, has more complex installation, one beneath nose probe and another beneath tail cone. French is first place to follow production of second-hand Mirage 3Cs with the 3 version.

Teamsters Gain Ground in Aircraft Industry With Victory at Sikorsky

Stratford, Conn.—Teamsters' union gained its first foothold in a major aircraft company last week, winning by 91 votes the right to represent hourly employees at Sikorsky Aircraft Division of United Aircraft Corp.

Of 4,076 employees eligible to vote in the National Labor Relations Board election, 3,377 voted. Teamsters, 2,234 of the Independent Aircraft Guild, there were 37 votes challenged, not enough to change the outcome, for a total valid vote cast of 4,091. Fifty-nine votes were voided, either because ballots were left blank, signed or marked in some other fashion, and 178 no play votes did not vote.

Teamsters campaigned on a 20-point program, many of them involving an erosion of benefits. But some felt they were in a position where the Teamsters enjoyed the new local and began to bargain for their first Sikorsky contract. These union include:

- Elimination of the merit raise system and substitution of an automatic progression formula based on length of employment.
- Closed shop.
- Job assignment to be posted for bid previously on the basis of seniority.
- Shift premium by seniority.
- Absolution for all grievances instead of only certain grievances under present rules.

The Teamsters charged an unfair election in engineering effort search plants. They attacked it to move into one place where the climate is temperate, but not to waste substantial amounts of money in hopeless organizing efforts. The election resulted in a local union, however, when the Teamsters published an advertisement a few days prior to the election carrying an endorsement from 15 other local unions in the Bridgeport, Conn. area. Allegedly, they will the local union of the Bridgeport police department.

This resulted in exchanges within the police department because of the no picketing if Bridgeport police would be required to police a leave strike at Sikorsky.

The Teamsters union claims 10,000-15,000 membership in its Industrial Division, including locals at Minneapolis-Hussey, Rochester, Conn. and Delco Electric Co., a subsidiary of the Singer Sewing Machine Co.

The Teamsters have selected union boss at Lechew-Merrett in Georgia, where an estate feud of the local National Army of Mechanics was into internal problems. But the local union has since reorganized. Teamster head

quarters in Washington said it would not send organizers into the area until there was sufficient interest to warrant an investigation.

Hourly employees previously were represented by the United Auto Work on, AFL-CIO. After a protracted strike last year, the employees voted to denounce the UAW.

The employees remained without a union affiliation until last month when an election was held to decide between the Teamsters, the Independent Aircraft Guild or no union (AWN Nov. 21 p. 27). Nine were sufficient votes, to quickly and the union election between the two leaders in that election was scheduled.

Satellite Data Alters Radiation Belt Theory

Washington—Outer Van Allen radiation belt is made up largely of protons, rather than electrons as had been thought previously, according to data transmitted by the Explorer 12 satellite.

Although the electron concentration in the belt is considerably less than that calculated by earlier satellites, the National Aeronautics and Space Administration said these are enough to present a hazard to manned space flight.

Explorer 12 was launched Aug. 15 in the period of a Delta launch sale. It had an expected maximum lifetime of a year, but transmission ceased without warning only four months after its 103 orbits, each lasting 25.5 hr. The Explorer carried 20 particle detectors, including electron sensors developed by Dr. James A. Van Allen and Dr. Brian J. O'Gorman from the State University of Iowa. Leo Debnar, NASA's Goddard Space Flight Center developed the particle detector experiment.

Other information returned by Explorer 12 indicates:

- Some protons are trapped by solar fields, based on degradation observed from unperturbed cells and cells protected by glass coatings with thicknesses of 3, 20 and 60 mils. Unperturbed cells degraded by 50% after two orbits, 3-4 mils coating reduced to a 1% degradation, and no power loss was observed from cells with heavy coatings.
- Solar protons acting on the solar cell solder attacked the satellite spin rate from 17 to 15 rpm.
- Full range battery of dual solar storage was observed, and data should provide new information on proton events. Be-

cause of the large mass of information returned—more than 3 billion data bits—data collection will not be completed for another six months.

• Successful first use of solar collectors in a Goddard satellite.

The dual satellite was on its eighth of 45,000 mi and a package of 477 mi. It is expected to return the above plus in about 20 months.

Soviets Studying Air Route to Antarctica

Moscow—Possibility of establishing direct air communication between Moscow and the Soviet pole recently lost in Antarctica is being explored by the Soviet Union.

An Il-18 and an An-40 left Moscow Dec. 15 on 25,000 mi. trip which is expected to include stops at Delhi, Rangoon, Jakarta, Davao, Sydney, Cincinnati and possibly the U.S. Marine Air Station at Kaneohe.

The Il-18 was equipped with fuel tanks and is expected to remain a few days in Miami, a Soviet port base, before heading to Moscow.

The An-40 cargo aircraft will be fitted with fuel tanks and will make several flights in the Antarctic region, landing on the Soviet station at Vostok in the area of the South Georgia Pole surveying camp and group research. Expedition Chief Alexander Almazov said that establishing an air connection if successful, would make it possible to reduce the Soviet Arctic expedition staff from more than a month-long stay to less than a week, even including intermediate landings.

Apollo Subcontractors

Washington—North American Aviation Space and Information Systems Division last week announced selection of four top tier subcontractors and award of \$41 million in contracts for Apollo spacecraft systems.

The subcontractors, which were included in the North American proposal as potential members of the Apollo team (AWN Dec. 11, p. 17), are Collins Radio, which will receive \$40 million for core electronics, electronics, battery and digital electronics; International Astronautics; Minneapolis-Hussey, which will be the flight controller; and Lockheed, which will be the environmental system and Radio Shack, which will be the recovery system.

Final selection of the subcontractors will come when North American and the National Aeronautics and Space Administration award the contract for the Apollo capsule. Negotiations have been under way since only this month (AWN Dec. 4 p. 26).

Disarmament Dispute

Washington—Continuing has developed within the Senate Foreign Relations Committee as to whether a Soviet pledge on the economic impact of disarmament should be released to the public. The issue was made by the staff of the disarmament subcommittee, headed by Sen. Robert Kennedy (D-Mass.). It is based on the reply to questionnaire sent to 140 major defense contractors plus 100 other firms (AWN Feb. 11 p. 24).

USAF Aids UN From France Despite Ban

Paris—U.S. Air Force aircraft are continuing to aid French aircraft in an emergency of the United Nations effort against the communist Chinese effort of Keping.

The aircraft, including Lockheed C-130s of the 312nd Air Division located at Evreux and patrol bombers Douglas C-124s at Chateaufort, are not affected by a French law voted earlier this month prohibiting planes with ammunition destined for the UN forces to operate over France's territory or from its aircraft.

France, a strong opponent of the Katangese army, has been supported by the former French Congo, which has drafted a similar prohibition and closed its airport in Brazzaville to such aircraft. USAF planes used to ferry troops to the Congo in support of the Katangese operation have on UN-banned ammunition aboard on flights from or to Taiwan and, on other routes into Africa, are avoiding the territory of the former French Congo.

An Air Force spokesman in Wiesbaden last week said, thus far, he could only say that the French prohibition has not affected the efficiency of the U.S. military operations in support of the Congo operation.

Army May Join USAF In Space Projects

Washington—Air Force next year may ask the Army to participate in some of its space projects as the belief the two services have complementary space capabilities.

This possibility emerged from an all-day meeting Dec. 14 at the Army Ordnance Missile Command, Huntsville, Ala., where Army leaders briefed the Air Force on their space capabilities (AWN Dec. 11, p. 26). Speakers said, although no final decisions were reached, Air Force space leaders were highly impressed by the Army's possibilities.

Gen. R. A. Silverman, commander of the Air Force Systems Command, attended the briefing. He said it was the first time such an Air Force Army meeting had been held at that high a level. Gen. Silverman was accompanied by Lt. Gen. Harold M. Eitel, Systems Command deputy for research systems and Maj. Gen. Charles J. Ryland, senior member of the Systems Command's Space Systems Division.

Flight Test Scheduled For Sounding Rocket

Washington—An 15-ft., 4.5-ft. long meteorological sounding rocket that has been built since 1959 has been directed by Adolphe Research Corp. First flight test will be made from Wallops Island, Va., next month.

Called Metrac, the long-burning solid propellant rocket will carry a 375 lb payload to 100,000 ft. Using a 2.75-ft. diameter air rocket motor in a booster, it will carry the payload to 30,000 ft. Payload will sense temperature, pressure and humidity and will transmit results. It also can carry a bag of cloth for deployment and descent of a parachute.

Both the rocket and payload were designed with composite parts. Metrac is aimed at government and scientific markets. It would be used for sounding balloons, as launched by balloons. A parachute deploys at peak, altitude to give descent of the payload and give longer observation time. Metrac can be fired from an existing launch facility, has no complex launch launchers and is firing the company's Atlas sounding rocket.

News Digest

USAF Being Maintained—Three-stage solid propellant missile was successfully tested on Dec. 10 from the Atlantic Missile Range from a site at Cape Canaveral, Fla. last week. This was the second successful test shot in three days and the sixth development shot from the Air Force Missile Test Center.

Cosmos 991 jet transport received its Federal Aviation Agency aerobically test certification last week. Aircraft will be scheduled for a series of test flights early next year. Modified version of the 990 will be tested for certification at a later date.

University of Virginia will take over management of the Navy's long-range theoretical research program in rocket and jet propulsion from Princeton University, effective Oct. 1, 1967. The pro-

gram, known as Project Squid, has been in existence since 1946.

De Havilland Trident D19-121 three jet transport is scheduled to make its first flight Wednesday from the Westfield Production Plant in East field.

St George Edwards, managing director of British Aircraft Corp., has been appointed chairman of RAC subsidiary companies, Bristol Aeroplane Co., English Electric Aviation and Vickers-Armstrong (Aircraft).

French government has ordered since MS 760 Plan jet engine aircraft from builder Matra-Sudavia. Four plane aircraft is powered by two Turbomeca Marboré 4 turbojets. The new order brings company's domestic first jet carrying backlog to 51. In addition, 91 orders have been placed by 10 foreign customers, including 36 to be built under license in Argentina.

Dr. H. Abbott, 35, director of Advanced Research and Technology for the National Aeronautics and Space Administration, will start Jan. 2 after 12 years in a government scientific and computer center. Abbott said his future plans are indefinite, but he expects to make his home in New Hampshire.

Thunderbolt 2 series began with a successful launch Dec. 14 from Wallops Island, Va., in the joint National Aeronautics and Space Administration-Advanced Research Projects Agency-Lancaster laboratory study of reentry and atmospheric reentry. The first stage rocket attained an altitude of 357 mi. and a reentry velocity of 14,000 mph.

X-15 No. 3 Flies

Los Angeles—Flight No. 3 of the X-15, this plane Dec. 18 with National Aeronautics and Space Administration test pilot Neil A. Armstrong at the controls.

The aircraft is equipped with an adaptive control system developed by Minnopa (Minneapolis) which automatically changes gain in all three main axes as flight conditions change. The system also compensates for air density variations with the aerodynamic system (AWN Dec. 15, p. 34).

The 17,000 lb. thrust Thorolite XLE 99 engine will add 30% power for the flight. Maximum speed of 4,495 mph is expected, or 6,000 ft. It was also strong's third X-15 flight and its last with the design group.

The flight had been delayed because of problems with the engine of the Thorolite XLE, but was not for the flight. Total flight time was 41 min., first time of launch to touchdown.

Airlines Concerned Over Sales Programs

Closer look being taken at strategies as traffic continues to drop; scientific marketing may result.

By L. L. Doty

Washington—U.S. domestic airline executives, publicly blaming the 1988 traffic decline on a variety of factors, are staying silent on a problem which privately concerns a growing number of carrier officials—the effectiveness of current sales programs.

Throughout the development of modern air transportation, sales department heads have been treated as privileged groups, insulated with fringe benefits often dwarf other departments. The continued growth of the industry—a steady annual traffic increase of about 12.15%—appeared to make such treatment warranted.

Now, however, with traffic down this year an estimated 2% following a less 1980 year of rate increase only 1%, many airlines are taking a new look at sales strategies. The shift could well be a full transition from outmoded sales methods to long-range, scientific marketing programs within the next few years.

Some carriers have already launched marketing programs aimed at modernizing old sales approaches, but thus far, the effort has been meager. The prime problem has been heavy costs, particularly in the conduct of basic marketing research studies, starting point for all such programs.

Research Areas

Without research, determination of markets is pure guesswork. Today, airlines too rely on speculation on such problems as what delays cause travelers from flying, the cost of the current trend from freeways to basic travel or the future increase of logging new traffic sources.

Most research conducted by the industry has been in the area of route structure and marketing, utilization of flight schedules to meet business activity and in preparation for Civil Aeronautics Board cases. American Airlines has a marketing research program. American, Eastern, TWA, United, Boeing and Douglas are currently sponsoring a survey of the travel market (AW Dec. 13, p. 47).

W. A. Patterson, president of United Air Lines, which has taken a significant lead in marketing a marketing program, had this to say on the problems of traffic development:

"Members of our industry were pre-occupied (by the Civil Aeronautics Board) to meet and agree on what they would propose in service to passengers. Thus,

there is naturally good living weather throughout most airline services. They say that November should be a busy travel period, but that cancellations and delays due to weather seriously reduce traffic volume.

Despite November results, the bottom of the past two years, during which traditional growth funds came to a halt, is a capacity expanded, should also be used for handling travel business against outside influences. As Patterson points out, there are divergent opinions as to how this should be achieved, but some of them have emerged as the result of critical looks at current sales methods.

In general, the airlines have sold, and are continuing to sell, services as their prime product. That has been the chief weapon in the struggle for business.

This was effective in some markets where expansion and expansion. Now, however, many sales officials feel that too much emphasis on services, and on the equipment and personnel supporting these services, is ineffective marketing.

Methods Unaffected

They claim it is not penetrating into the private automobile travel market, and on order to reach such markets, the airlines must use the largest potential source of a new market. Some officials state that the industry's present market is made up largely of experienced or traveling, who are already acquainted with air, and who are not as likely to be attracted by a sales pitch centered around services.

Others feel that the airlines have reached a peak in the services they can provide that are not likely to be reduced rather than expanded because of the cost element. Many feel that an individual airline can continue to prosper its image in the public mind by being at the forefront of new developments in the industry's competitive field without plugging its services, which at the same time penetrating the automobile travel market.

Some thought has been given to a joint industry marketing and research program, but opponents of this idea that cooperation within the industry will be weakened as a result. Proponents are confident that an industry-wide program will decline the way to new traffic and new markets and that the competitive element will be strengthened by the drive to capture a few share of the new business.

Airlines, generally, have been con-

cerned about the need to keep their sales efforts in. Because of a lack of an adequate market research study, the airlines were lulled into believing their market would continue to expand without intervention until at least 1970. There are still many who are convinced that the recent traffic increases in business, that population growth and business expansion will soon reverse traffic increases.

The high cost of conducting a new marketing program, and the inevitable disruption and redeployment of sales departments that will result have contributed to the industry's reluctance to make the move now. With profits being replaced by a more balanced expansion are being discouraged.

Nevertheless the airlines need for some time to see business, a full fact that the CAR now serves the industry's traffic problem through "agency of service" on-airlines and the possible way that more agencies will learn the number of carriers is giving new life to the move toward new sales philosophies.

Lufthansa Orders Two Boeing 707-320Bs

Lufthansa German Airlines has ordered two Boeing 707-320Bs to replace its 1951 and 1954. Price tag of the order is \$12.4 million.

The airline's Boeing jet fleet deliveries on order include two 707-320Bs, including two 707-320Bs, seven 737s and 12 Boeing 727s. An additional 707-320Bs was lost in a training crash. Lufthansa's Boeing order represents a total investment of \$130.4 million, including spare parts.

The latest order was made necessary, Lufthansa said, by legitimate maintenance needs.

Lufthansa's 1960 delivery of about 97% of the Boeing 707-320Bs and maintenance facilities was attributed primarily to the high cost of its new equipment, spare, extended service and maintenance facilities and higher Boeing rates for the equipment. The 1960 delivery came with a loss of \$67.3 million for 1970.

Total revenue was \$31.5 million in 1960 and \$77.5 million in 1970. Overall capacity rose to 150 million ton-km in 1960 from 127.5 million ton-km the previous year, an increase of 18%. Two miles sold during the same period was 109 million, 67% more than the 69.8 million in 1959.

Passenger revenue totaled 1,372,679 in 1960 and 1,738,675 in 1970, for a 27.3% increase. Freight and mail amounted to 20,980 U.S. tons. Passengers load factor increased from 54% to 58%.

SAS May Reduce Convair 990 Order

Copenhagen—Scandinavian Airlines System, whose Fleet 1981 Jones suspended from the previous record has established last year, is expected to take delivery of one of the Convair 990s which may be replaced by a new aircraft planned to replace it.

The airline, which last week reported a deficit of \$17.5 million for the year ending Sept. 30, probably will cancel two 990s which it had ordered directly from General Dynamics but accept delivery of two 990 aircraft it is expected to lease from Boeing.

The carrier also has considered possible cancellation of the two Boeing 990s, but such a move would cost a host of problems and could result in the missing delivery cost between the two lease orders which the firm has been trying to get out of on lease from SAS for the past year and a half.

In its effort to cut costs, SAS probably will continue to fly its two 990s, and further jet expansion plans are expected. Personnel during the past year was reduced by a bulk of 14,000 in Sept. 30, 1981, to 12,000 at the end of the first year, largely through employee buy-outs and by cutting flight attendant positions, according to the company. A similar reduction is not yet contemplated for the current year.

Following a board of directors meeting last week, the airline announced last week that total revenue over the past year amounted to \$118 million while total costs in operating expenses and overhead were \$135.5 million.

Fleet 1981 Jones, which included a second order for the state air from Sweden, Norway and Denmark, total \$118 million. SAS said the budget for the current year will "result in a reduced but still sizable deficit." A further reduction in all costs and increased contribution operations will be necessary.

Losses over the past year, the airline said, were due to an extraordinary traffic decline and an extraordinary increase in operating costs. North Atlantic air use has been due to cost caused by the continuing inflation in jet operations. These costs mean high SAS said.

SAS revenue in 1981, excluding aircraft sales, totaled \$118 million in operating with \$118.4 million the previous year. Aircraft sales amounted to over \$14 million for the total revenue figure of \$132.4 million.

U.S. Reconsiders Warsaw Treaty

Washington—OIA agencies conducted last week by the Intelligence Group on International Aviation (IGIA) were accorded with information that a reconsideration of the Warsaw Treaty of 1972 would be submitted to the State Department soon.

The issue is whether the U.S. should withdraw from the Warsaw Convention which limits liability for death or injury to \$5,000 on international flights in which the Hague Protocol of 1955 which amends the Convention to increase limits to \$16,000. Proponents of Senate ratification of the Hague Protocol include airlines, insurance companies and law professors.

Opponents who constitute a substantial majority of the 97 parties to the convention with IGIA, are mainly claimants' attorneys. In 1972, the U.S. had ratified the Hague Protocol. A total of 38 is expected to meet at international law.

No official U.S. action has been taken on the Protocol as yet. The Executive branch did not submit it to the Senate until 1979 and the Senate Foreign Relations Committee has not yet held hearings.

However, the Kennedy Administra-

tion has shown an interest in negotiating the Convention, which would modify the Protocol in that U.S. participation is considered. As a result, Senate ratification of the Convention is expected when Congress convenes next year.

IGIA is composed of representatives of the State, Commerce and Defense Departments, Federal Aviation Agency and the Civil Aeronautics Board.

Red China Viscount Fleet

London—Red China government has ordered five Viscount jets from British Aerospace. The order is for five Viscount Viscount helicopters, transports aircraft purchased from British Aerospace Corp. (AW Dec. 11, p. 47).

British Aerospace has no major facilities in the Far East, aside from a licensing office in India. However, the company has developed potential markets in the Far East. The British government and talks could lead to other orders of Chinese origin are ordered from it.

British Aerospace officials indicated that Viscount jet talks have started but nothing has finally been settled.

FAA Orders Suspension of Supplemental

Washington—Opening certificate of supplemental flights, local point of a controversy over supplemental carriers after one of its aircraft crashed recently killing 77 persons, has been suspended by the Federal Aviation Agency until the airline can show cause why it should be allowed to resume operations.

FAA Administrator Nighth E. Hobbie took the action last week after a joint Civil Aeronautics Board-FAA investigation revealed deficiencies in Hobbie's maintenance, pilot training, and record keeping. Hobbie said the airline had voluntarily suspended operations since the crash but after the investigation he had decided to invoke a legal suspension.

Hobbie said that as recent events he had resolved the operating certificate of an air operator and suspended the certificate of another carrier until they bring their training and records up to FAA standards.

Hobbie ordered the FAA problem in packing the supplemental carriers. He said the supplemental carriers are joint CAB-FAA partnerships, plus certain air line operators and contract carriers which come under FAA certification. Hobbie said about 45 airlines have the problem of getting their aircraft into the FAA standards. All FAA can do is set standards of training, maintenance, inspection and standards of the carrier operating agencies. Hobbie said.

Hobbie said his agency had the right to take into account the total capability of air carrier to meet operating standards. Carriers that operate under CAB operating regulations will have their management and economic status

reviewed by FAA if they are operating near bankruptcy, Hobbie said.

Earlier, Hobbie and CAB Chairman Alan S. Boyd discussed their Dec. 15 meeting with representatives of 25 supplemental airlines held in conjunction with the J-AN-CAB investigation of the supplemental industry.

They said the supplemental firms did not intend to start a holiday industry, that must have some form of permit, authority and a better knowledge of the amount and distribution of funds available for airline activity.

Boyd said the investigation revealed maintenance, training and bookkeeping deficiencies on the part of a few airlines. Most carriers, Boyd said, are operating within the law. He said the supplemental industry is like any other cost carriers are good and a few are bad. A similar investigation of the scheduled carriers will probably be used similar deficiencies. Boyd said.

Both Hobbie and Boyd said there is general agreement in the industry that what a method is better, better and safer supplemental.

As to specific recommendations to guide future supplemental operations, Boyd said that there was little FAA or CAB could do until Congress settles the question of the airline's economic. In addition of the CAB-sponsored bills (AW Sept. 18, p. 4) now before the Congress, Boyd said, the supplemental will come to operate after Mar. 14, 1963—the date their temporary operating authority expires.

If either bill is passed, the supplemental carriers will have permanent status and CAB can then impose strict rules of financial soundness, Boyd said.

DC-8 Modification

Los Angeles—Boeing program to improve Douglas DC-8 directional control and stopping ability after showed an emergency landing a carrier was. The report, first about 180 aircraft are being modified, 56 of these at the factory. By last week, 15 DC-8s had been retrofitted at its plant. Federal Aviation Agency advised that the modifications be completed by the end of February.

Structural changes include providing additional hydraulic system connections (AW Dec. 9, p. 36) and more means for braking power to increase controllability during landing roll, allowing possible to balance between forward and reverse thrust after touchdowns, and adjusting possibility of hydraulic leaks.

Delivery to airlines of parts for aircraft No. 28. Two days per month on request to make changes. The majority of DC-8s are still in the air, but some are in flight. DC-8s to the West Coast for modification in a timely manner.

In the meantime, Hobbie said his agency would, support and service related to the supplemental carriers.

He also said the supplemental airlines were strongly urged by FAA to continue their training programs and to continue their maintenance functions and to continue to keep operating records. "We made some progress," the administrator said.

Hobbie stated that the first step in this direction would be an informal agreement to form and use a central pool of aircraft data. Such a pool would be employed by the centralized scheduled airlines to advise pilots of adverse weather hazards, weight problems, and other factors of importance.

Both Hobbie and Boyd warned generally concerned with preventing the supplemental airlines. Boyd cited the consequences of the supplemental and made during the holiday period. The Korean War and Hobbie's relative operations, in addition to creating an effective reserve of military assets.

Boyd mentioned that the supplemental were better over the public's they had occurred from the past. He cited the press to recall that during 1956-57 the supplemental did not have a single fatal accident involving passengers. In 1959 the supplemental had one passenger fatality. The present figure, he noted, shows four fatal accidents in 1960 and two in 1961, in addition to an accident in which a group of passengers were stranded in Ireland.



Continental to Load Passengers Via 'Drawbridges' at Chicago

Aluminum 'drawbridges' passenger boarding ramps will be installed by Continental Airlines at O'Hare Field, Chicago, and are expected to be in operation at the carrier's new gateway in January. The 10-ft high, 5.5-ft wide, mobile structures can be raised 35 feet and swing horizontally in a 20-ft arc. Employment time is 20 sec. Last 5 ft of the ramp telescopes.

Excursion Rate Repeal Brings Protests

By Gloria Gorman

New York—Airlines involved in the holiday campaign and all well brought in by sudden suspension of the transcontinental excursion fare still were trying to catch up with their competitors to retail holiday booked through the end of the holiday and up until March.

Meanwhile, Civil Aeronautics Board was reviewing volume of complaints from disappointed ticket holders who blamed the Board for the cost up.

The Board announced Dec. 13 that the fare, paid Dec. 15, would not be extended. Many complaints and complaining followed.

While the airlines are not officially blaming the Board, the CAB has been complaints of cost increase are being backed to the Board by the carriers. The Board also indicates the airlines might have avoided the holiday excursions by filing for an extension covering the holiday period only. As a result of what it believes to be unfair criticism, the Board will not change the current practice.

Furthermore, both United and American opposed the excursion fare and went along with TWA's request for extension to March for competitive reasons only.

Another source of criticism of the Board has been charges attacking the Board for alleged bias and not being in its handling of the matter.

The excursion fare, filed last August by TWA with American and United following not satisfactory, argued Dec. 13 and the Board announced on Dec. 13 that the requested excursion would

not be granted. A complaint received in the three airlines themselves tried to advise holiday of excursion tickets that these tickets would not be valid at the selected rate after noon on Dec. 15.

Last week, the carriers still were trying to catch up with their competitors to retail holiday booked through the end of the holiday and up until March. American at mid-week was about three days ahead of the backlog. TWA was several days ahead. These two airlines were able to purchase holders of the excursion fare by asking through their reservations desks. United had not met in the cards which passengers held the excursion tickets and non-refundable.

While the airlines are not officially blaming the Board, the CAB has been complaints of cost increase are being backed to the Board by the carriers. The Board also indicates the airlines might have avoided the holiday excursions by filing for an extension covering the holiday period only. As a result of what it believes to be unfair criticism, the Board will not change the current practice.

Passenger Notification

Furtherance of the excursion fare tickets were supposed to have been notified of the possibility of cancellation. TWA stamped its protest, while American and United relied on verbal notification. However, many passengers apparently hadn't gotten the idea and were outraged when they found they had to pay additional fare to make their trip.

Most, however, did pay the additional fare. United offered only about 3% of its excursion tickets. American's estimate of known cancellations was 15% and TWA's was about 10%.

However, the percentages probably

were higher because airlines might have held cancellations tickets.

TWA had called about 1,000 people by mid-week and said only one is 10 minutes late. As an example of the magnitude of the task, TWA had to pull reservation cards for all flights and left out the excursion passengers for notification.

This involved taking personnel off the reservation phones, when they were especially needed in the busy holiday season.

Members of the excursion fare passengers were students and military personnel, along holiday vacation. To meet the industry without enough money to make up the difference, which was in excess of \$187 for a Boston-Los Angeles jet coach round trip—trained in their return for many hours at the higher fare and accepted airline checks for the difference.

Some wanted to know if the airline would make up the difference in fares and not charged when the airline said no.

Also affected was passengers on an ongoing international flight, who held tickets of continuing flights at the reduced rate.

TWA said it had no expectations that the excursion would be denied. It is no surprise for CAB to deny an extension, according to the airline. Some airline officials suggested that future situations of this kind might be handled by changes in CAB procedure allowing the carriers more time to prepare a fare change after the Board's decision. This, according to the suggestion, might be accomplished by speaker Board consider-

Aeroflot Reports on An-24 Transport

Moscow—Russian technology An-24 short-haul transport has been put into operation reporting after encountering flight test problems and undergoing major changes in testing procedures.

In the brief of a long series of measurements that the An-24 would go into regular service soon, Aeroflot revealed that:

- An An-24 without retractable gear when it went into a spin during flight tests. Extreme aerodynamic properties showed that the aircraft was not at all such one it should not have been subjected to the wing system which put it into the spin. Aeroflot said.
- Now using configuration with retractable gear. Early in its service the An-24 would carry 32 passengers in its basic version and 40 in transport version.
- An-24 cruising speed is about 470 kilometers per hour (292 mph) instead of the 500 kph (311 mph) first mentioned. Then, too, that will be 50% faster than the cruising speed of passenger B-16 which An-24 will replace, along with B-12s, to be a full complement of An-24s is considerably less than B-16s, despite momentary delays.
- An-24 starts a delivery passenger size which is less than a size in the foreign jet. Entry to the passenger cabin is also possible through the cargo hatch in the lowest part of the fuselage.
- Numerous tests from improved runway have confirmed that the An-24 can take off in less than the 1,000 ft unstrengthened performance estimates.

upon on by automatic procedures allowing more time after a decision.

One caveat, TWA, also said that specific procedures for working the public in such cases should be developed by the Board or by the airlines. TWA said it strongly urged as a prerequisite that the law be subject to CAB approval at during the period when another carrier did not act according to that view, there would be needed working procedures.

CAB acknowledges the possibility that procedures might be subject to its argument, but points out its cutting back on what it would consider a factor allow. For example, but projects might be filed not less than 30 days before effective date except in special cases where interest Board approval. CAB, if it is to act on a project, must do it within that time or the law is automatically in effect.

If TWA and the other carriers in the case had filed two months in advance, a Board spokesman said, CAB probably would have made its decision within 30 days and the other month would have provided a cushion for making the adjustment. But airlines often want to file in close to the effective date is possible for competitive reasons.

TWA estimated that about 90% of its total coach passengers booked from New York to Los Angeles during the Dec. 11-15 period were holders of the maximum fares. The airline, in support of the extension, says it was carried out during the first two and a half months of operation showed 50% of passengers using the fare new business.

But United doesn't believe the fare generated enough new business to justify itself. American estimates the decrease of maximum fare holders from 1961 to 1962 was 10%, and estimates it lost from \$145,000 to \$207,000 last September alone on the fare.

Tipton Is Re-elected As ATA President

Washington—Air Transport Association President C. Tipton at president and carried off new districts at the annual membership meeting held Dec. 16.

The new districts are: C. E. Beard, president of Boeing Airways; C. E. Wadsworth, president of Delta Air Lines; L. Cummings, Jr., president of New York Airways; J. E. Connelly, president of Pacific Air Lines; C. C. Tillinghast, Jr., president of Trans World Airlines. Tipton's term is one year.

John M. Sichter, Jr. is elected vice president and CBE Smith, Jr., is elected secretary.

Funds for Beacon Implementation To Be Sought; New Study Begun

Washington—President Kennedy will ask Congress for enough money in Fiscal 1963 to implement Project Beacon, a study of beacon implementation, a new, \$500 million air traffic control system to be developed during the next five years, according to Federal Aviation Agency Administrator N. E. Hubble.

Despite the President's emphasis on a balanced budget for the coming fiscal year, Hubble said last week, "We have been allowed enough money to proceed with these [five Beacon report's] recommendations." But the Beacon report (AW Nov. 13 p. 14) predicted that FAA's Research and Development Series test will need more than its current allocation of \$67 million to get started on the new ATC system.

Although the report was generally concerned with the flow of air traffic in the U.S., Hubble claimed that a separate task force had been appointed to design a navigation and control system for the North Atlantic. This separate task force, Operation Awareness by Hubble, is being developed by Trans World Airlines, the first carrier to rely on Doppler radar navigation systems to transatlantic flights.

Three major departments of the FAA—Flight Standards Service, Air Traffic Service and Research and Development Service—are sharing responsibility for Operation Awareness, as Agency spokesman told Aviation Week. One aim of the project is to develop operational standards over the North Atlantic. But an interdepartmental committee from the study probably cannot be implemented without interdepartmental accord.

Hubble, who toured Europe recently, believes it is a very substantial task that Western allies of the U.S. will design and build to ATC system not compatible with the system controlled by the Beacon report. Unless clear guidance can be established, he said last week, it will become difficult to control effectively, amidst a huge air congested North Atlantic system. He also stressed the need for working with other NATO defense contractors, "in such cooperation and planning."

As a first step in this direction, Air Traffic Service has begun collecting traffic flow data from about seven European airlines, FAA reports. This information, he said, will be used to continue to be received by the Agency until June, 1963.

On Dallas International Airport, the 5118 hours terminal scheduled to be fully operational here in October, 1962, Hubble suggested that "significant growth" of the airlines are attempting

ing to get predicted landing fees lowered by increasing the airline lounge concept. Twenty of these longer, catch centers about \$25,000, have been closed by FAA to improve passenger to them from aircraft using Dallas.

Dallas' landing fees, Hubble said, will be higher than the national average but lower than those charged by several other international airports. Early fees costs indicate that airlines will be charged a maximum of 25 cents and minimum of 15 cents per thousand pounds gross loading weight per aircraft. This would equal \$100 to \$90 for an international jet transport.

At Washington National Airport, by contrast, last month negotiated with the airlines are 15 cents per thousand pounds of loading weight.

Because of the airport's high cost of landing at Dallas, U.S. airlines generally have not been enthusiastic about the new terminal. Although Hubble denied that the carrier threatened not to fly there, he said that airlines, he indicated that they will be continuing such as those will find that there are various ways in which they will be persuaded to use the airport.

In his discussion of Dallas problems, Hubble said, "It's been said that I'm tough in Puerto Quetzala, Mexico, FAA administrator. I think this [the airport] will find me tougher—though a little more gentle in selecting targets."

In line with a new study of the Port of Washington, he said, last week (AW Nov. 27, p. 35), Hubble announced that FAA would appoint a group of new officials called "harass officers" to afford a "trial-type" system to those involved in the study. The group will be made up of representatives from both branches would be held only when necessary as a result of a certificate issued by FAA as a possible punishment.

The hearing officers will be lawyer employees of the agency. At the earliest time will be appointed, with two more to follow later. Mark in pages of the U.S. Circuit Court, the hearing officers will be able to enforce the FAA report, though some of the FAA report.

Turning to airline industry financial problems, Hubble remarked the progress for a study of the subject is, "The industry is not doing well. A host of factors other than fuel costs or schedule cutbacks are causing them to have been driven from using the nation's airlines, he said.

"We've got to emphasize safety, not just alcohol and overhead," Hubble said, adding that "we need a national position, not regional ones."



Boeing-Vertol 107 Baggage Bin

Removable baggage bin of Boeing-Vertol 107 from tandem helicopter is shown in extended position. The bin can be removed at rear main door and replaced with a bin loaded with baggage. At intermediate stops, bin is rolled out, and down, and baggage removed from compartments, loaded by walking. Dragging down at extreme right is during which covers lifting mechanism.

Wage Demands Cited as Reason Airlines Want Fare Increases

By Robert H. Cook

Washington—Continuing wage demands by airline employees are being cited by many industry observers as the prime reason for the growing number of fare increase proposals now before the Civil Aeronautics Board.

Comments that the industry may be unable to sustain a healthy rate of traffic growth in time to keep pace with future labor demands in being underscored by the sharp increase in labor costs brought about by subcontract flight programs. A slight reduction in flight costs would have been more than offset by the necessity for increased maintenance and sales personnel.

Airlines Approaching

The airlines are also approaching what wage cuts are view of both pilots fully experienced increases in the mandatory retirement age of 60 for pilots and acceptance of the Passenger report

(AW Oct. 23, p. 35), by flight crew unions and the airlines.

Speakers for the Flight Engineers Association have estimated that airlines may want to implement the pilot training recommended for flight engineers as the Passenger report could approach \$60 million over the next few years.

Further, according to the wage cost picture is the prospect that the Air Line Pilots Ass'n may renew its past demands for more extensive capital raising. Airline carriers are the high cost of providing the training now cited by the Federal Aviation Agency as a primary reason for not adopting the ALPA recommendations as far during Elwood A. Quenda's administration.

Overall labor force in the scheduled airline industry has climbed from a total of 167,193 employees in 1958 to more than 166,000 by the end of 1960. Preliminary financial statements show that the industry's wage bill has jumped \$75 million this year, with \$16 million of it

on increased pay and wage benefits and the balance to 50 employees. For the year ending Sept. 30, the industry's employment total reached 171,616, with an annual total payroll of more than \$2.1 billion. In 1958, the industry's payroll totaled \$250 million.

As an example of the labor burden of railroad operations, Trans World Airlines reported a payroll cost increase of nearly 55% within an 18%.

The drastic drop in the industry's rate of annual traffic growth, which reached a average 35% last year and is now predicted to drop a 25% drop this year, underlines the airlines' overburdened and far too small capacity.

Underlying the industry's revenue and stock of 6 cents per share passenger rate, however, point out that the 1960 revenue passenger miles total would have to drop a gain of more than 1 billion to cover the losses. \$25 million in labor costs. This was almost exactly the total savings gain recorded last year. Expressed in other terms, the airlines would need an estimated 45% increase in total operating revenues to match the increased costs of wages.

Cockle Flight Inadequacy

Wage cuts also provide a significant clue to the why a number of flight have asked CAB for fare increases, which would raise the toll on travel services, lower the level of first class. Travel costs estimated last year that about 37 cents of their revenue dollar was taken from coach fares, as compared with 51 cents on first class. The actual yield on coach fares significantly short of meeting the current total airline costs, which now stand more than 92 cents of the revenue dollar.

A rough breakdown of the salary expense, including the cost of fringe benefits, payroll taxes and training expenses, shows that nearly 14 cents of the dollar carried goes for flight crew costs. This was approximately the current cost of maintenance cost of an aircraft, oil and gasoline taxes, along with fuel insurance and rentals. It exceeds the actual depreciation rate for both light and ground equipment. In 1960, 3 cents of the dollar was allocated to 11 cents of the salary cost is allocated to pilot and engineers and the balance to hostesses.

Aircraft overhead increased wages about 5 cents of the dollar, oil, sales and insurance personnel, 4 cents, labor maintenance, 3 cents, airport reservation and ticket agents, 2 cents, cargo agents, 2 cents and record-keeping personnel about 2 cents. A variety of other employees, such as baggage handlers, cleaners, personnel and purser personnel, transverse cleaners less than 1 cent of the dollar. Payroll taxes, fringe benefits and traveling expenses would consume 5 cents more of the revenue dollar.



EL AL 806/105 707-420 transoceanic transport equipped with 17,100-lb thrust Rolls Royce Conway turbojets is being tested to land passengers at Tel Aviv's Lod Airport. An additional wing is being added to the small transport before it can accommodate the increasing number of incoming passengers. Proposed new and intermediate terminals is scheduled to be completed by 1964.

Report on El Al Israel Airlines—Part II:

El Al Aims at Across-the-Board Economy

By Cecil Browder

Tel Aviv.—In addition to striving for high load factors, El Al Israel Airlines pays close attention to aircraft utilization rates in its constant battle to keep operating expenses at a level that permits the nonsubsidized carrier to turn a profit.

Despite the carrier's respectable load factor record (though some of the statistics (AW Dec. 18, p. 56), El Al's managing director Gen. Eliahu Dini, who is firm in his belief that a good showing in this field alone is far from sufficient.

"I'm dead set," he says "against those people who sit around squawking 7.0 or 8.0 figures out of 30."

A company like ours, a relatively small one, must have a high utilization rate. It's only by using a work in New York with a 100% load factor and lose \$20 million a year. You have to improve load factor, utilization, per capita production, sales expense.

Unless we use long-term expense within the proper framework, it will not come from it's work." Last year, El Al ranked third among the major airlines in per capita sales.

El Al's utilization figures for its aircraft have been good. Based upon a 165-day year (other than the 30-day calendar count when the airline would fly, the 707 record averages out to approximately 9 hr per day per aircraft, the Britannia between 7 and 8.4 hr each, with a high of up to 11.5 hr, according to Chief Engineer Chaim Finkelshteyn. Before the arrival of the 707's when the Britannia was being used

over the Atlantic as well as to Europe and the Middle East, the latter aircraft's 165-day utilization averaged out to over 9 hr per day.

Records between available for the 17,500-lb thrust Rolls Royce Conway turbojet engine used on the El Al 707's is now 1,400 hr and will soon be boosted to 1,600 hr. The next, and Pratt & Whitney turbojet used, will be up to 1,700 hr. The 4,415-rpm Bristol Siddeley Proteus turbojet propeller for the Britannia has a potential life of 1,500 hr between overhaul, and El Al is now planning to boost the figure to 1,600 hr.

The carrier continues to presently being carried out in England under contract, while more engines of the Proteus are handled by the government-owned Israel Aircraft Industries located near the field at Tel Aviv's Lod Airport for El Al's administrative and engineering headquarters. The Conway overhaul probably also will be transferred eventually to IAI.

For the moment, however, the Conway due for overhaul are flown to London on regularly scheduled flights flown in the fifth pod maintenance designed by Boeing. A single technician accompanies the aircraft on the flight to and in the job's reversal in London.

"We have the fifth pod maintenance and removal down to a five set now," Finkelshteyn says, "and it doesn't delay the schedule at all. We had been told that we would get a 5% speed penalty with the pod, but actually it is less negligible."

Off-loading passengers, however, can sometimes be disturbed by the fast

operation. "They are the pod being removed and think that the aircraft has an engine."

Overload of the Boeing 700B's 18,000-lb thrust Pratt & Whitney JT4D-3 may cause some initial problems since, initially at least, they cannot be overhauled in Israel. El Al and other 720 customers are sharing in the cost of development of a fifth pod for the 3D to be flown, but it will not be available by the time the first aircraft wing, and initial spares will have to be delivered by other means. Overhaul again has not yet been selected, but the task may be given to Pratt & Whitney soon, once the fifth pod is developed, the engines will be flown in the U.S. on regularly scheduled New York flights.

El Al already is a member of the engine spares pool among Conway operators and will join a similar consortium for the JT4D. For Conway engines are kept on hand and spare engines for the 700B will be purchased.

Airframe maintenance is carried out at El Al's expanding technical facilities at Lod on a programmatic basis, a system instituted here with the arrival of the Britannia, and as much of the major work as possible is scheduled for the relatively slack winter season.

The airline's on-time departure rate also has been "very good," according to Ben-Ari. Average on-time departures for the Britannia and 707s was 74.3% in September, 81.5% in August, 83.4% in July and 80% in June.

Technical delays in September, Ben-Ari says, totaled 37 hr, in August 76 hr and in July, 68 hr. Commercial delays—holds on aircraft to meet the air

craft of connecting flights, air—was averaged 13 hr in July, general handling and traffic control difficulties 5 hr, and weather only 68 min. Commercial delays amounted to 11 hr in August, traffic control and ground handling delays in another 75 hr of the total over two holds.

To remain healthy in an area of stiff competition and rapid technology, El Al has adopted a policy of fast amortization of equipment so that the carrier can be financially prepared to move quickly with the appearance of superior long-range transports.

The 707, for instance, will be written off within three years of delivery. Over 40% of the cost of the four Britannias already has been written off, and the two second Constellation—for which El Al hopes to find a market—have been amortized completely. Yet then comes mid-air, El Al seems to find the economic strength of the superior aircraft.

In explaining the cost of buying or leasing as a matter of value policy plus the necessity of exchanging in dollar receipts into Israeli pounds at the official rate, Ben-Ari says:

"Take the smallest thing, perhaps for instance if you buy them here at the approved price you pay a much lower price than you would pay in, say, Amsterdam."

"On food, quite a lot is imported into Israel, but we don't report it. So we pay the imported price plus the duty plus the middle man. A five-cent can of soup is up to 14 pounds (about \$8.40 at the official rate) when prepared here as opposed to 2 pounds (\$1.20) in London, and this doesn't include service districts or taxes."

For the expensive transatlantic aircraft, Gen. Ben-Ari agrees with U.S. proponents of a Mach 5 schedule, declaring that "there's no point in going into Mach 2 because the economic margin at that speed is not sufficient."

He doesn't believe, however, that a Mach 3 aircraft will be available by the early 1970s. "I have no doubt," he says, "that there will be a supersonic



707 IS BOLLOD into new El Al maintenance bays for a progressive block check between timetables. Other maintenance facilities and shops now under construction in an El Al expansion program will be ready in February under present plans.

aircraft. Once the engineers decided to do something, they will do it. But I think it will take a lot of time. . . . There are a number of problems that will be solved."

But it will come, and the traffic will grow, and I agree that there should be as much as a 50% increase in [Israeli] price. Some one in a hurry will pay \$500 more to get this and that."

As El Al operates official agents, seeing that the advent of the supersonic transport will be a need for first class, tourist or coach. There'll be just one class, and we won't send the large dinner and all the service that is necessary now."

Despite commercial director Menachem Golan's belief (AVI air export) in more services to non-European points or elsewhere, some of which are now being negotiated, new accounts in Israel include the airline's in line with the 707 or 720, but generally with El Al's stock with its present program of equipment "until another revolution" is devised.

With the status now fairly established, most El Al flights and maintenance crews are recruited from the ranks of former Israeli air force pilots and technicians and then put through a rig-

orous course at Lod. Present classes are instituted simultaneously on both the 707 and 720.

El Al's training program which includes:

- New trainees are sent to work for one month in a luxury hotel hotel. "The important thing," training manager Gudrun Bodin says, "is that it gives them some opportunity to become a good shopkeeper. They are the proper way of handling wines and liquors and even such things as how to polish glasses."

- Second step is enrollment in a six-month German-made "Tourist Office special course to obtain all the knowledge necessary about Israel." Two of the first weeks are spent studying historical points of interest so that the trainees will be capable of discussing them knowledgeably.

- Third step is a full two months of lectures on the various types of tourism to report, where these recruits probably will be, the questions that can be expected and how to answer them.

- Fourth and final step is a one-month course of actual cabin training in Lod's 707 and Britannia mockups.

(This is the concluding article of a two-part report on El Al Israel Airlines. The first part appeared in Aviation Week Dec. 15, p. 35.)

El Al Growth—Fiscal 1956/57—1960/61

| Equipment | 1956/57 | 1957/58 | 1958/59 | 1959/60 | 1960/61 |
|--------------------------------|---------|---------|---------|---------|---------|
| Boeing 707-420 | | | | | |
| Britannia | 4 | 3 | 4 | 4 | 4 |
| Constellation | 4 | 4 | 4 | 4 | 4 |
| Number of flights | 993 | 994 | 1,279 | 1,572 | 1,918 |
| Number of flight hours | 11,891 | 12,140 | 13,840 | 16,410 | 20,494 |
| Passenger miles (in thousands) | 10,120 | 10,120 | 12,120 | 14,120 | 17,120 |
| Freight miles (in thousands) | 1,912 | 1,912 | 2,112 | 2,312 | 2,512 |
| Number of passengers | 467,440 | 467,440 | 514,440 | 561,440 | 608,440 |
| Passenger miles (in thousands) | 10,120 | 10,120 | 12,120 | 14,120 | 17,120 |
| Freight in tons | 384 | 387 | 431 | 473 | 515 |
| Number of cargo in tons | 137 | 137 | 157 | 177 | 197 |
| Number of cargo in tons | 137 | 137 | 157 | 177 | 197 |
| Passenger load factor | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 |
| Over-all load factor | 85.0 | 85.0 | 85.0 | 85.0 | 85.0 |

AIRLINE OBSERVER

Domestic headline coach revenue passenger miles in November rose 10% compared with the same month last year, but first-class traffic dropped 9%. Increase in all categories of traffic for the month was 11.2%. Load factors continued to fall—a drop of 5.1% to 71.5%—while available seat miles jumped 17%. Northwest showed the largest gain in coach traffic—60%. Only Delta, National and Northwest reported increases in first class traffic. Highest load factor was American's 77.5%. Six carriers had load factors below the 50% mark.

National and Continental are optimistic over chances of the CAlB Accidents Board approving their proposed merger (AW Dec. 18, p. 39). Both carriers also hold high hopes of joining New York with Chicago as part of the one-airline structure. This is based on fact that the United-Capital merger left no competition between Chicago-Cleveland and Cleveland-New York. Eastern is expected to be the only carrier opposed to the merger. Long-term objective appears to be to bring Northwest Airlines in the group, but because of the vigorous opposition the move would stir, the plan is not being pushed.

Commerce Department will form a government-industry advisory committee on civil aircraft values to make a study of the orbit potential of aircraft operated by military and to develop a uniform pricing formula that can be used for Civil Reserve Air Fleet, War Air Service Patterns and Aviation War Risk Insurance.

High percentage of airline pilots are opposing the Forgingers report because they feel it fails to require a sufficient amount of training for flight engineers and copilots. Last year, pilots made several attempts to persuade E. B. Quesada, then administrator of the Federal Aviation Agency, to expedite training requirements for the two groups.

Growing breach between Soviet Union and Red China has resulted in a sharp decline in air traffic between the two countries. Aeroflot's schedules between Peking and Moscow have been cut to two T-104 flights per week, and these reportedly are operating almost empty. Only other known air service connecting the two countries is a Chinese-operated service between Peking and Hanoi on a once-week schedule.

Mexican airline pilots are actively contemplating grounding all flights during darkness and instrument weather as a means of forcing the government to build navigation aids on airline routes into Mexico City. Pilots have been told lack of funds prevents installation of aids. Pilot charge that multi-faceted ILS, VOR, and air traffic control system are endangering airline operations on these routes (AW Oct. 12, p. 47).

Witch for Lockheed-Gearbox Co. to accelerate production of G-410 series box truck-type transports from a current roll-out rate of about three per month to about 10 per month during the first quarter of 1962. New schedule will reflect the top priority accelerated rapid-response order by the U.S. and its allies.

American Airlines and Boeing Co. have asked the Civil Aeronautics Board for authority that would permit the airline to sell to the manufacturer 30 Boeing 720-423 turboprop transports. Boeing would pay American between \$1.1 and \$1.3 million for each aircraft. The sale is tied in with the purchase of 15 Boeing 727 transports to be delivered to American during 1962. The 720s will be delivered to Boeing on a one-for-one basis as the last 10 727s become available. The agreement has a clause that will permit the delivery of the 10 720s to coincide with delivery of the sixth through 15th 727, if deemed desirable.

Continental National merger proposal could cause a fresh eruption of the crew complement issue between the Air Line Pilots Assn. and the Flight Engineers International Assn. Continental engineers are pilot-qualified men less of ALPA. National flight engineers, who recently signed a two-year contract, are FEAA members who hold airframe and propeller ratings.

SHORTLINES

Air Transport Assn. reports airline revenues conducted by U.S. controlled air carriers totaled \$18.8 billion in October, compared with \$19.2 billion in October, 1960.

Delta Air Lines has Civil Aeronautics Board permission to suspend service to Havana and further reduce Delta's Panama traffic has dropped from a peak of 40,125 passengers in 1957 to 5,079 for the first 11 months of 1961.

Eastern Air Lines reported it was prepared to operate up to 385 extra jet flights to Florida and 42 to Puerto Rico for the holiday travel rush. Extra flights will operate until Jan. 5.

Lake Central Airlines reports that as of Jan. 16 it will serve Chicago through O'Hare International Airport instead of Midway, but will continue its existing service at Midway. The airline had it made the move to provide better connections with transcontinental and international flights.

Northwest Airlines has asked CAlB to remove a restriction prohibiting a free crossing, local passengers, between Tampa-St. Petersburg-Clearwater and Ft. Lauderdale, Fla. on its four daily flights between Midwest points and Miami. Northwest said a new routing the authority between Midway Airlines reduced service among these points on Dec. 1.

Pan American Airways reports new low light-weight electrical containers have been developed for its freight packaging system. The containers have cubic capacities of 75 and 15 cu. ft., and thus can reduce the 1,000 pieces of an average cargo load to 24 and 112 pieces respectively.

Trans Caribbean Airways has ordered its second DC-3 from Douglas Aircraft Co. The aircraft is scheduled for delivery in time to begin operations next summer. Trans Caribbean received its first DC-3 in November.

Trans World Airlines is equipping its jet fleet with engine vibration isolators to detect early signs of engine malfunctions. The \$151,000 program is scheduled for completion during 1962.

Western Air Lines has CAlB permission to suspend service between Calgary and Edmonton, Alberta, Canada after experiencing declining load factors during the past two and one-half years. Suspension will be effective between Jan. 1, and June 15, 1962.

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CIA Czechoslovak Airlines, which operates a fleet of small aircraft for air test and multi-purpose activities in addition to its scheduled flights (AW Nov. 31, p. 41) is now extending its duties to provide helicopter charters overseas. Several Mi-4 and Mi-6 helicopters were also sent to the Czech-Mex contract. In November, they were operated for the first time for the transport of heavy material. Mi-4s (lower left) are intended to be used in the lead role to attack on the right side of the Etna region. Note extra fuel tank on fuselage.

Czechoslovak Airlines Adds Helicopters to Service



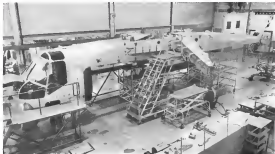
Mi-4 helicopter is shown leaving over Czech and jet while making a pickup for fuel. The helicopter is being operated on an experimental basis for the transportation of rocket supplies ranging from heavy building materials to fuel.



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AERONAUTICAL ENGINEERING



FIRST SIKORSKY S-64 TRANSPORT now helicopter for West Germany soon completes its final assembly from its prototype shop. Powered by paired T4-WA IPTD-32A turbo-shaft engines, the S-64 is essentially a lifting machine which can carry a variety of loads internally as in detachable pods. Structure is designed for easy maintenance, entire upper deck of fuselage is walkway zone. Hydraulic lines, electrical wiring and control controls are externally along the fuselage sides. Flares door extending from left-hand side of cockpit in radio altimeter for low flights only.



Sikorsky S-64 Can Lift Up to Nine Tons

By David A. Anderson

Stuttgart, China—Sikorsky Aircraft S-64, designed in its all-purpose main, port and flying crane, is about ready to be rolled out of the factory here for the start of ground tests.

The months of flight testing will follow, ending sometime in summer of 1962. First deliveries of an S-64 to West Germany, currently the only customer, is scheduled for the end of 1962.

These ideas behind the design of the S-64 was to produce a rugged, power-saver that would be in air transportation when the trailer truck is to over-the-road transportation. To achieve that goal, Sikorsky designers said or developed in many existing components as possible. They draw on extensive demonstration experience with the joint-coupled powered S-60 crane helicopter. They designed to a specification drawn up by the West German Air Force. And they borrowed these features as an aircraft which is powered by a pair of Pratt & Whitney IPTD-32A turbo-shaft engines and which is intended to be able to lift almost 55% of its own gross weight in payload.

Performance guarantees show the S-64 will carry 60 fully equipped troops a distance of 100 miles an hour. It will land in extremely strong, no-fee period for 200 feet an hour, an eight-ton load for 100 feet an hour, or a nine-ton cargo for a distance of 50 feet an hour. These figures are based on a sea-level standard day, which phase and include a 10% fuel reserve.

Crews Concept

The S-64 is a two-crew lifting system with a winged main landing gear that can straddle a variety of load shapes and sizes, including a series of fixed pods designed to hold cargo, people or specialized tools and equipment.

The high fuselage, whose tail end level bottom is 112 in. above the ground, carries a retractable main rotor system, with a four-bladed hub motor perched high on an oil-filled boom at one end and a five-ton rotor along under the other end.

This suggests looking combination can lift nearly 21,000 lb. as two work up to 30,000 lb. of towing tension, enough to submerge heavy vehicles on land or ships at sea. Sikorsky's Walter W. Lank, senior project engineer on the S-64, says that the ability of the transport/crane is handled solely by its capacity and the cooperation of the user. Among other items desirable for the S-64 is a military vehicle as its use is a supply system to fuel fuel tanks or



TRANSMISSION BOX (above) for S-64 is biggest built by Sikorsky so far, will handle more than 8,000 hp through two input shafts. Another shaft ends could be connected to another propulsion system on such wings. Below: Sikorsky mechanics complete installation of system and various components.





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THREE-VIEW DRAWING of Sikorsky S-64 in outtings of West Germany as first shows the general arrangement of the, transport/transport helicopter. Tail rotor is shown in its normal and outstretched of wheel pods or cargo.

water to forward combat area, and to carry missiles, weapons and their supporting power packages or small maintenance shops to field firing points. As a cargo transport, the S-64 can fly in with a loaded pod, and exchange it for an empty one without having to be unloading and loading each to be completed.

Finally, the pods can be released for specific missions. Internal arrangements for anti-aircraft warfare equipment or for microscoping can be installed in specific pods, ready for use as needed. In the civil aviation field, an S-64 could be used to pick up passengers, who have already boarded the "people pod," at the destination where arrival and they get out to the mainstage to meet jet airports now under discussion or planning. After arrival and delivery of the pod, which could be towed by tractor directly to the airplane for loading, the S-64 could stop on a grid of passengers waiting to go down and deliver them to their destination.

Lifting System

Power and lift for the S-64 are supplied by a pair of Pratt & Whitney JT12-12A turbojet engines rated at 4,750 shaft horsepower each, driving a combined main rotor and a four-bladed tail rotor. The main rotor assembly is tilted forward and to the left by three degrees in each direction. The forward tilt is to keep the loading more level in cross flight; the lateral tilt is to keep the wheels level during hovering.

Many of the components of the rotor system cross directly from the Sikorsky S-64 (Army II 17A, Navy and Marine H-64) two-engine helicopter. The main rotor and tail rotor blades, the main flapping and drag hinges, the tail rotor head, gear box and intermediate gear box, and the main rotor servo all

came unchanged from the S-56. Rotor head design is like that of the S-56, except that there are no attachments to the rotor hub instead of the five of the earlier machine.

Reason for the increased number of blades is to increase rotor solidity (ratio of total blade area to swept disk area). This in turn means a reduced blade loading (flight weight divided by total blade area) and therefore a smaller blade chord.

With the smaller chord, the shaft in the transmission center is decreased in the blade shape through a complete rotation. This reduces the resistance to blade torque, but in the cost savings, those torque, causing a large share of helicopter vibration. Consequently, the aerodynamic vibration level of the S-64 should be lower than that of the S-56. Main rotor blades, which are a new material NACA 0012 section. Blades are constructed with the most space near most distribution.

Below the main rotor is the tail rotor, which has a long, tapered cone with the main rotor shaft protruding from the top and joined power shafts angling off the sides. Both rotors can pick to spin shaft shafts in the forward and the rear direction. There are also lateral power shafts, which could be selected for propeller by using them to drive, carbide propellers through variable shifting and gearing.

Four main tail shafts, two ahead of, and two behind the main rotor, have 5,800 ft of 82.4 ft in the S-64 drive line. There is further provision for additional shafts of 2,000 ft, which could be used to drive, and one behind the main. Tail load on other conditions would be 5,700 ft.

The freewheel or brake as one of the Sikorsky engineers call it, is a part, shaft structure, with a couple of heavy inner cone balls, which to take the loading



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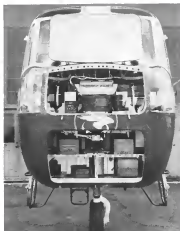
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SECTORY S-64 COCKPIT wrapup shows installation of electronic rotor control components in nose compartments. Hinged doors lift to give crew access. Lower bay can be sealed to withstand stresses on ground; upper regions damped.

gear. There are helical connections at the protrusion, breaks, and pit of the cable and the other in the tail rotor. The landing gear also attaches with belts.

The entire top deck of this thin-walled box structure is a walk area for main housing, access steps are built in on the landing gear and the landing gear doors. In addition to the powerplants and some sensors, the top of the boom carries the main hydraulic system components in a solid (unpneumated) box, on the port side just aft of the rotor pylon.

All hydraulic lines, wiring and control pedestals run along the outside of the boom for easy maintenance. The cargo which is installed in a large door, underneath the main rotor transmission and back with the bottom of the landing gear. Aircraft landing system is installed ahead of the first cabin in the boom.

Major factor in the choice of materials for the structural components was to get the lightest structure, first would

handle the effects of both elevated temperatures and fatigue in addition to providing the required static strength. At best, the structure, near the powerplants, will become heat-soaked, regardless of heat barrier used in the lowest, and the expected stabilization temperature was pegged at 250F.

Basic Materials

Basic materials investigated were 2024 and 7075 aluminum alloys; the components of long-time, high-temperature strength existed in both of the 2024 alloy, which was therefore chosen for primary structure adjacent to the powerplants.

It also was used in critical fatigue areas of the structure, not necessarily because it was the best choice, but because there is the most extensive fatigue experience available with the material.

The drive shaft in the tail rotor has multiple bearings, each riding in a flared-filled rubber tire, sitting so that the

shaft can seek its own neutral position. The "hard" points, to which engine loads can be assumed, are located on the first prototype case in 17 places, which will be eliminated one is one as they prove superfluous. There are two sets of 18,000-lb. supports, which straddle the rotor counter, one on each side of the fuselage. Six points on each side, three forward of the rotor and three aft, are rated at 5,000-lb. capacity. The final three sets at 3,000 lb. capacity each are located at the cockpit seat on each side of its air bulkhead and on the boom fairle in aft.

Final arrangement is expected to be four hard points, each with a retractable spring loaded with 18 lb. of cable. In operation, the ground landing would pull out enough cable against the spring takeup to attach the end to the load. Takeup would tighten the cable, the pilot would lock each set. Three retractable loads can be handled, but only in such a sequential order.

Each of these four sets can be retracted to store up the cable or to get another eight inches of ground clearance if circumstances demand and not a reserve takeup for overload conditions. The hydraulic retracting cylinders also are not in common chambers to reduce the load from vibration.

An additional feature of the S-64 that is aimed at simplifying its crew operation is the landing landing gear. Its pumping hydraulic fluid in or out of the main gear cylinders, the whole assembly can be moved and locked in eight inches. The crew can then straddle a pallet, lower their feet eight inches, secure the pallet and stand in its legs to their full operational height to give the load ground clearance. This is an aid when in the eight inches provided by the cable and structure.

The eight-inch motion of the gear gives a clearance in a safety factor in a hard landing. There is a hydraulic line in the landing gear assembly so that if the gear sets in higher than the design figure, the line bursts. This allows the remaining eight inches of gear travel to be used to absorb the extra energy of the hard landing.

The tail sled, which is positioned to keep the tail rotor from striking the ground during nose-high landings, is fixed up out of the way so soon as there is weight on the landing gear.

Landing and take-off edges of the landing gear are fixed edges are closed with gear fiber bearings. The final stage of the fixed section is that of a van, fixed with a large trailing edge corner. The trailing stage was chosen to give a pocket inside in the semi-circular corner attitude of the S-64.

An auxiliary gas turbine power unit, the two German BMW 0012 power plant is used to furnish aircraft electrical and hydraulic power when the

rotor are not running. Thus the S-64 can be self-sufficient at a remote spot where there is no auxiliary ground power equipment.

Pilot and copilot positions are designed in a conventional manner with one exception: the copilot's seat, which has track and swivel, faces to some extent the pilot's. The reason for this is that the copilot takes over as main operator when a man being sent two steps down and behind the actual copilot position (he must be able to get in and form that seat back and forth).

Both pilots' seats tilt back 30 degrees in an emergency position when the helicopter is being swiveling and assumes a nose-down attitude.

The pilot's position on the right of the cockpit, which is conventional in helicopter design, the standard orientation is lost. Cockpit stick is floor mounted between his legs and the call letter stick is in his left. The control stick is topped by a sensitive size side with eight horizontal switches.

Engine instrumentation is mounted between the two pilots' seats, a scale between the pilots carries the main six basic and control controls and indicators and other auxiliary sensors.

Electrical Controls

All engine controls from the cockpit to the powerplants are electro-hydraulic. Electro-mechanical actuators mounted on the engines respond to cockpit signals transmitted by wire.

For engine operation, the copilot takes the shifting seat or the rest of the cabin. This position has conventional helicopter controls also, with the exception that the cyclic pitch control is on the right-hand console of the seat to give the copilot better visibility of the rotor area.

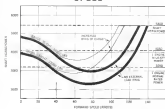
Engines with the S-64, which had a smaller seat being crew, occupies a position, showed that the copilot had less vision of the operation, more in some than ground conditions. The airflow from the rotor downwash starts forward at this area in low range near the ground.

For a typical case, operation, the pilot position the S-64 is the rest and the copilot takes over from the rest seat for the flight down. The reason that control through the lift landing or landing or operation, and only when required control to the pilot after the helicopter has cleared the immediate area.

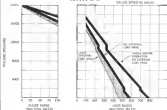
Sikorski's Automatic Stabilization Equipment (ASE) is installed in its own lever system which can be thought of as the master of ASE, is adapting directly from the S-64 design. When in a steady climb in the copilot's electric stick at the engine operator's position, the current data directs to the sensor valves, bypassing the ASE system. Cockpit controls and the control unit

S-64 PERFORMANCE SUMMARY

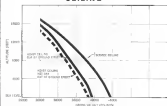
SPEED



RANGE



CEILING



THREE GRAPHS show pilot's performance summary of Sikorski S-64 transport/transporter.



COCKPIT LAYOUT of Sikorsky S-64 is conventional except for extra space space around copilot's position at left. During cruise operations, he is prone to shifting seat behind his control flight position. Engine instruments and warning lights are mounted on panel between pilots; cruise controls and other system controls are console-mounted. Pilot's collective stick mounts tiny console.

ing unit now modified from that of the S-60.

Cruise operations in gusty conditions have been simplified in design by including an auto-pitching linkage in the ASL to increase the stability in gusts. The S-60 experience showed that the cruise operator could do the same quality of job in gusts but had to work harder because of traditional tail changes in the rotor.

Sikorsky claims that almost all cruise operations can be performed with the helicopter on its landing gear, rather than in the hovering attitude. There is one extra advantage of ground operations, and that is that the vehicle at rest is electrically grounded. The static charge buildup on an airframe, which will discharge upon a clanging cargo hook, can give the unsuspecting ground handler an awful jolt.

S-60 Lessons

The experience gained during two years of flight testing the S-60, both by military and civilian pilots, produced a wealth of detailed operational information for the Sikorsky engineers. Among the specific design lessons learned were:

- Use of novel wheel landing gear arrangement rather than a tailwheel type. The S-60 tail wheel assembly was taken from the S-55 for reasons of cost reduction, but it got in the way of load placement from the rear.
- Helio engines aren't the answer for a cruise. The two turbine engines of the S-60, while rated at 4,000 hp each, do not have to deliver that much to the

rotor system under normal operating conditions. This is, in effect, supplying constant engine at maximum standard conditions, leaving a margin of available power for hot days or high altitudes.

- Cruise operations need an unobstructed view. The S-60 position was on the same level as the pilot's and did not give the operator the full down and side visibility that he will get in the S-64. This was a definite disadvantage in the S-60 design.

In addition to inputs from the S-60 design, Sikorsky engineers worked to requirements stipulated by the West German government. But those requirements had three goals: even further back on a document by the joint French/Italian/German commission which dealt with the development of weapons carriers to the three countries' military forces.

The commission decided that it needed a crane with a 12- to 14 metric ton capacity (26,455 lb to 30,859 lb). This range they felt would handle anything that could be transported on a standard European railroad flatcar. But the West German military took a realistic view of the requirements and decided that there would be a considerable time period before such a large-capacity crane helicopter would be available. They requested revisions from the technical commissions to develop their own crane design, and to build it around a lower capacity that could be met with existing types of crane design and available personnel. The German view was that this would

provide them with a relatively inexpensive means of exhibiting the prime role of a helicopter—ground troops before, carrying civilians—leading to a development program.

The resulting competition was entered by Sikorsky, Finmecc's Fiat design and Italy's G. Agusta. A G. Agusta entry was based on its design.

In the evaluation that followed, the Germans chose the Sikorsky S-64 design and ordered two units. The company is building a third in a demonstrator and prototype test vehicle.

Current Status

Current status of the program from the first aircraft for Germany on the final assembly line, with detailed installation being made and scheduled for delivery by the end of the year. All components will have completed their test program by that time, also.

The rotor system and the engine dynamic system, which started tests in July this year, will continue to spin under test until sometime in 1981.

Sikorsky S-64

Basic Characteristics

| | |
|--------------------------------------|-------------|
| Dimensions: | |
| Main rotor dia. | 73 ft |
| Tail rotor dia. | 15 ft |
| Overall length with blades retracted | 67 ft 6 in |
| Overall height at main rotor | 15 ft 6 in |
| Overall width, blades folded | 21 ft 10 in |
| Wingspan | 34 ft 9 in |
| Wing load | 39 ft 9 in |
| Ground clearance | 9 ft 4 in |
| Weights: | |
| Gross weight | 33,800 lb |
| Useful load | 20,700 lb |

| | |
|--|----------------|
| Performance: | |
| Maximum speed at sea level with limited payload | 245 kt |
| Maximum speed at sea level with external load sling of 12 kt | 182 kt |
| Cruise speed at sea level with external load sling of 12 kt | 95 kt |
| Vertical rate of climb at sea level | 300 ft/sec |
| Hover ceiling, out of ground effect | 6,000 ft |
| Maximum range, both empty | 680 statute mi |
| Maximum cruise, single-engine cruise | 100 statute mi |

Conditions: Performance guarantees are based on sea level standard day conditions, a crew of two plus three passengers, and a 1,000-hr engine.



Navy's David Taylor Model Basin built 8 ft x 15 ft model at left and conducted series of wind tunnel tests of its attitude. Electric motor power model for free flight tests. Prototype's concept of wing-ground-effect airplane is at right. Navy aerodynamicists are conducting wind tunnel tests on wings like the Puck's body hangs on skin speed capability and stability.

Military and Civil Ground Effect Designs Tested

Sikorsky's desire for more mobility plus the increased market for cheap but speedy air water transportation, especially in underdeveloped areas, is spurring the development of vehicles which skim over land and water on a cushion of air.

Such conventional air cushion vehicles in the past have encountered many government and military aerodynamicists that the concept is sound and worthy of further development. The Navy and Maritime Administration both demonstrated the growing U.S. interest by awarding air-cushion contracts in recent weeks for the design and construction of ground effect machines.

Navy signed a \$2,840,000 contract with Ball Aerospace Co. to build a 23-ton air cushion vehicle (AW Dec. 4 p. 34). A primary concern is whether such air cushion vehicles, also known as ground effect machines (GEMs), would be effective in anti-submarine warfare.

U.S. Marine Corps would get ground effect machine (GEM) 1 at top right, built by Nettus Research Associates, for water gun research testing at Navy's David Taylor Model Basin. Two 73 hp Isuzu YE125-1 gas turbines augment drive the 12 x 21 ft, 3,020 lb vehicle up to 20 mph. Vehicle has airplane-type control stick. Army believes air cushion vehicles promise added mobility, especially for taking troops and cargo over water and rough terrain. Army's aviation Division of Ford Motor Co. is building, such as experimental vehicle with its own money (middle right). Flexible 2 ft thick tube in diameter, powered by air cushion itself. Two 200 hp Lycoming G-540 engines power vehicle.

Removable vehicle (bottom right) carries four persons, can attain 75 mph. The company's Gyroplan Spectator gets left from 170 hp Lycoming piston engine (not visible in photo), and forward propulsion from electric engine on tail. Ducts along sides of the vehicle are stabilizers. Vehicle is 14 ft x 31 ft, weighs 4,000 lb.

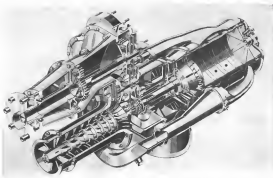


GEM 1 vehicle was built by Nettus Research Associates, has been extensively tested.



Ford Motor Co.'s Gyroplan Spectator concept shows would have flexible skirt. Buys Raytheon's Motor Co. Gyroplan Spectator gets left from a development program. Below





ALLISON T63-A-5 helicopter free power turbine engine shown in cutaway showing how hot gases and compressor stages. A-5 and A-5 variants have an stage. As shown at left, gases through the axial stage and out into the centrifugal stage and then pass out through two doors, to the combustor. Hot gases then engage the gas turbine which drives the compressor and then turn the power turbine which is mechanically connected to reduction gear mounted on top of the engine.

Redesigned T63 Engine Ends 50-hr. Test

By Larry Rouda

Indianapolis—After three years of development, including one complete national redesign, the Allison T63-A-5 light-weight turboshaft gas generator free turbine engine has completed its 50 hr preliminary flight engine test (PFT). Results have been sent for acceptance to the Air Force Research Institute in Dayton, Ohio, for the Army.

Early this month, Allison, a division of General Motors Corp., announced that the engine, which is scheduled to power the Army's four-place light observation helicopter (OH-6A), could produce a guaranteed 250 horsepower at a dry weight of 1154 lb and a specific fuel consumption rate of 0.71 lb/hp-hr.

This weight is much more than the original goal set by the Army. Requests for proposals sent to industry in 1955 set the aim was to produce 250 hp in a package weighing 110 lb in a turboprop and 95 lb in a turboshaft. It took nine years of effort on the part of Allison and nearly 50 full-time staff to reach between the company and the Army—no doubt that this aim was unrealistic. The Army was so intent on the re-

design of the project two months ago that it decided to send proposal requests for an alternate engine as a backup to the T63. This called for an engine weighing 137 lb. With this weight limitation, existing engines of greater horsepower would have difficulty qualifying by being derated. Companies entering the competition would probably have had to start from scratch.

Early Delivery Date

The Army's desire was due to the fact that deliveries of five engines each is scheduled to Bell Helicopter and Hughes rotors. Each of these airborne manufacturers is producing two LOH prototypes. One model will be chosen for production by one or more major factories. Long-range program is about 3,000 helicopters which will replace current five-year-old light and light engines.

The magnitude of the problem in developing this engine has been due to its small size, combined with a requirement for a compressor pressure ratio ranging between 6 to 1 and 8 to 1, and light turbine inlet temperature. The compressor ratio by diameter is 4.114 in. First stage turbine tip diameter is

6.17 in. and the second stage is 6.414 in. The compressor diameter is 5.5 in. Turbine gasifier turbine tip is 46.750 in. In one test temperature is 1,600° F. In the history of turbine engines out of the gasifier turbine has been keeping compression-ratio and turbine-entrainment at a minimum to hold back age at the lowest possible level. This also applies to important points and cooling points between components.

But what would be a small percentage decrease in a large turbine engine would be unacceptable, large, in a small engine where the percentage of leakage would reduce efficiency.

Overcoming these setbacks was one of the greatest challenges faced by the project engineers. In the compressor section that was utilized in an engine turbine which will be described later. But it was the original internal configuration which caused the greatest headache.

Army studies completed in 1957 showed the need for a 250 hp engine in small light and observation as possible. Four engine manufacturers submitted their solutions. As a result of this study competition, Allison was awarded a contract in June, 1958, to design and

develop the T63 engine. The contract was made called for the 10 lb PFT to be completed late in 1960 and the 150 lb final qualification test late in 1961.

Because the engine was intended for a wide range of use in including an OH-6A helicopter, Boeing VTOL, as well as other aircraft, the requirements included the ability to start stop and operate in a wide variety of attitudes from 30 deg. to 15 deg. just varied with a windmilling rate of 10 deg. to other side. It was also required that the engine maintain 250 hp on a 1000 deg and 285 hp at 6,000 ft altitude on a 91° deg. This latter figure is of special interest to helicopter engine designers.

The original engine, dubbed Type I by the company, was first run in the spring of 1959. Its run encountered difficulties due to high inlet temperatures which prevented full speed tests, and mechanical distortion which caused the turbine ratio to rise.

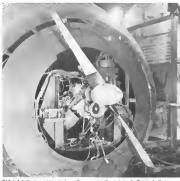
The overhauled power turbine design of the gasifier and power turbine was subject to these distortions with changes in temperature. In this arrangement the gasifier is on power turbine, shaft was mounted on a bearing which was mounted on the exhaust duct between the exhaust and the main shaft bearing. The opposite part of the shaft traveled inside the power turbine shaft and side on roller bearings, running between both shafts having the best rotation. This gasifier shaft was the compressor at the opposite end of the engine.

Then the two-stage power turbine large hollow shaft side hanging from the roller bearing. This design proved to be a weight saving but would not allow its alignment in operating temperatures.

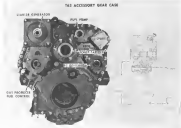
First tests made, but finally it became obvious that was little possibility of arriving at a mechanically sound engine. No amount of improvisation, estimated the 14° difference in compression flow and the 75% low efficiency and the power turbine bearing support distortion.

In mid-1959 a critical decision was made to scrap the initial aerodynamic design and turbine mechanical arrangement. All making of the Type I engine was stopped and all effort was concentrated on the new arrangement.

The Type II turbine section retained the basic T63 arrangement of major components. From front to back, the compressor still with a belt drive the two-stage axial compressor, the turboprop compressor and offset, the accessory drive gas box, which serves as the backbone for the engine, and on which all the major components are mounted, the two-stage power turbine and the two-stage gasifier turbine and the combustor.



T63-A-5 helicopter engine is shown here in complete test stand. Principal effort is now being directed on the A-5 model which are destined to power the Army's new observation helicopters.



PFT accessory drives, including one spin, are included in the T63 version, gas box. A second set of pump incorporating one pressure and six scavenging elements is also located inside the case.

Two doors are machined into, over the compressor, as air to the combustor chamber. Power is taken from the first and side of the accessory gear box in the turboprop section. In the turboprop version the reduction gear bearing is mounted at the same point. The new design called for new blades and new blades and a new flow in motion. The gasifier turbine was changed from a single stage to two stages. The gasifier turbine is steadily increased by two a roller bearing forward and the three bearing at the power turbine shaft, mounted between a front and roller bearing forward and a roller bearing

ing air. Separately, wings made of a special material were installed outside duct turbine units to assure maximum clear area at operating speeds. Dual outlet exhaust ducts were installed.

Revised requirements stated that the aircraft target for starting, stopping and operating was to be from 75 deg above horizontal to 25 deg below horizontal. This required cut corners and oil changes in order to assure lubrication at all mandatory attitudes thereon in maneuver points to pick up oil for transmission to the pump.

The compressor section was altered little in the redesign phase; the biggest change being reducing the number of axial stages from seven to six.

The outer case is made of light gauge stainless steel girth. The dropped, outer casing is attached to but not riveted to copper bearing. These areas later are in turn spot welded to the ring. An available plastic centrifugal seal into the case covering the hot section.

Leakage Reduced

When assembled, the rotor vanes fit the plastic liner so snugly that the entire build. It is then turned by hand until the vanes cut into the outer grooves in the plastic. This a tight seal is secured and leakage cut to a minimum. The plastic also provides a completely sealed outer boundary for the air flow. The cooling liner in the centrifugal compressor is aluminum, against which the vanes rub.

All turbine wheels and vanes are made in casting. These made use in required development of new technology in investment casting. The compressor and turbine wheels are single piece, or monolithic. Compressor wheels and rotor vanes are made of 17-1PH steel.

Iron steel. Turbine wheels are made of Inco 718C and the turbine vane assembly of HX31.

Compressor design and development created no great difficulties, since the single chamber approximated the size of Allison's 901 Military T55 turboprop chamber. (It is reported in the oil and of the compressor. Next in the engine point in the queue. Because of Federal Aviation Agency turbine rotor requirements, these will be two igniter in the production model. The combustion studies in the turbine and with 24 holes.

Hotspots Encountered

Only difficulties encountered during development were hotspots in the turbine outer gas path. Lower diameter was reduced from 6.0 in. to 5.5 in. and length increased from 10 in. to 12 in. These changes resulted from two-dimensional transient wave flow tests of the combustion turbine configuration. It was shown that secondary air penetration and wiring was occurring. The turbine inlet temperature pattern is now stable and consistent.

As stated, the first case is the motor for all steel accessories and assemblies. Principal problem presented in design outlined around the requirement that MIL-T-7005 low corrosion oil was required in the lubricant because of the severity of operating in weather as cold as -40°F. It was very difficult to establish length-diameter ratios for the bearing and size and location of lubrication points.

In the course of the power output there is a torque sensor which utilizes oil pressure to sense the axial force from fuel gas. A gas pressure readings is provided of torque. The power gas from also drives the power

helium turbine and the power turbine fuel governor. The governor gas from above the fuel control, the fuel pump, the oil pump, the start-generator, the actuator and the spin assembly pad. A spin element of pump is mounted inside the gas line. It has one pressure element and one reversing element.

The gas control assembly without air compresses weighs 14 lb. The spin and control elements are made of AMS 4144 stainless steel and the gas is made of AMS 4202 steel. Any turbine bearing are used throughout.

From the beginning of design it was determined to keep the fuel control system as simple as possible. Consequently, there are no electronic devices, potentiometers or other sophisticated controls. This is made possible by the 10,000-hr. altitude testability of the system.

A gas fuel control and a power turbine fuel governor controls the fuel system. These are, both located between the fuel pump and the fuel nozzle. The gas fuel control provides fuel for rapid acceleration and deceleration of the engine speed.

Tests Are Favorable

The power turbine fuel governor provides variable speed governing of the power turbine and serves as an over-speed protection device in takeoff applications. Aving simulations and extensive bench testing have shown that maximum stability, minimum weight and minimum cost can be achieved with the design.

There are three basic configurations of the T63. The T63A1 is a turbo-prop with a developed power of 1,000 hp. The T63A2 is a turbo-prop with a developed power of 1,000 hp. The T63A3 is a turbo-prop with a developed power of 1,000 hp.

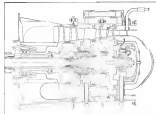


FIGURE 1: T63 engine configuration as at left. These are three bearing points for both the gas and power turbine shafts—the right, the main, and the left. Decoupled compressor is on right with bearings on left and right and size between combustion ducts.

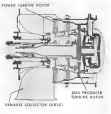


FIGURE 2: T63 compressor case showing the layout of the compressor components, including the compressor case, compressor, and fuel system.

T63-A-5 Model Specifications

One compressor section. Combination of a compressor and one-stage centrifugal flow compressor directly coupled to a two-stage gas producer turbine.

Power turbine section. Composed of a two-stage gas turbine section which is geared to the gas producer section.

Integrally gas reduction gas flow to a turbine output drive at base of gearbox.

Single combustion chamber, axial exhaust.

Governing: military specifications, MIL-E-10076, turboprop specifications, MIL-E-10006, turboprop, compressor test, MIL-W-10440, test, electrical, chemical or alcohol, thermocouple, MIL-E-10076, general specifications for turboprops, MIL-E-10006, performance control requirements.

Rotary are based on use of fuel with a lower heating value of 18,400 Btu/lb., MIL-E-10076. Alternate fuel, grade 121/145 fuel.

These were designed for an life of 874 hr. has been the A-1 version which has gone through the 50 hr. PRT.

The final configuration, for turbine test in the A-1, is the A-5 engine, where exhaust will point upward. It will have a reduced compressor and changed exhaust duct. This is the engine which will be tested at power of 150 hp. production use is to be 170 or 180.

The A-5 engine actually passed an official 10-hr. PRT in March of this year and was finally satisfactory. On a subsequent development endurance test, Allison and GMAT decided not to permit shipment of the engine used a wheel problem was solved.

Test Approval Deferred

In July, another test was also finally satisfactory. However, another development engine produced a failure of a compressor impeller reduce time and

the company did not request approval of this test as the official A-1 10-hr. PRT.

Another test period was terminated in September after 70 hr. 12 run by the failure of the hot stage turbine wheel duct. This test had been run at a higher turbine wheel temperature and higher speed than previous tests.

October and November marked the testing point for the program. A turbine wheel change incorporated strengthening, cooling and lower operating speed. A company test in August 1961 was successfully completed in October. Parts were accepted by the USAF representative.

Another company test in October consisted of 60 hr. of running in a PRT. Parts have the engine, although not perfect, were also requested in the USAF representative after the test. The engine has demonstrated the following capabilities:

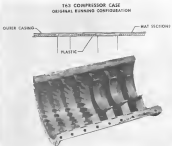


FIGURE 3: T63 compressor case showing the layout of the compressor components, including the compressor case, compressor, and fuel system.



Engineered Environment

The trouble used one of the power wings is a first of engineering environmental as well as arbitrary. The engine wing usually contains hundreds of pounds of wet and porous items inside the wing so that air can circulate around them. This moisture poses humidity for larvae during the hot, dry months.

How is humidity control being handled in your power? Proper and suitable functioning of electronic components as well as the efficiency of personnel depend on personnel humidity control. Specialized AAF equipment that "factors" the atmosphere for you includes many other engineered products built to rigid military standards.

AAF's full century of experience is available to you. Our engineering staff is ready to collaborate with yours in conquering environmental control problems. "Better as in our business."



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TY-45-A-2 turboshaft engine (landing sheet) incorporates shrouded mounting for external elements and bypass exhaust for ingestion installation. The 14 in. port exhaust incorporated into the A-5 turboshaft engine. TY-45-A-2 shown below is declassified by design. Turbine disk output of 6,852 gas is reduced to 1,897 gas.



T63-A-5 Performance Ratings

| | Shaft hp | Net disc time ft | Gas gas disc time ft | Output disc time ft | Alt disc time ft | Gas gas disc time ft |
|---------------|-------------|---------------------------|-------------------------------|------------------------------|---------------------------|-------------------------------|
| Takeoff/Miles | 150 | 10 | 40,750 | 6818 | 71 | 1,698 F |
| Normal | 123 | 10 | 47,890 | 6819 | 74 | 1,657 |
| 80% Normal | 101 | 20 | 46,100 | 6819 | 77 | 1,616 |
| 75% Normal | 100 | 30 | 44,953 | 6818 | 82 | 1,499 |
| Idle | 18 | 6 | 34,778 | 4580 | 63/6.9 | 1,429 to 1,600 |

Minimum fuel flow—125 lb/hr. = 12 lb/hr.
 (1) consumption—41 lb/hr.
 Air starts up to 34,000 ft and to 250 ft. time as speed.
 Absolute altitude 30,000 ft. at 8.0 gsm pressure rate.
 Capable of starting, stopping and operating from 75 deg. above horizontal to 45 deg. below horizontal.
 Capable of continuous operation at altitudes from 75 deg. above horizontal to 45 deg. below horizontal.

With gas producer and power turbine set at sea horsepower and power turbine speed of not less than 95% synchronous to takeoff power when first-mounted at sea level, provided power turbine speed is maintained at 100% after the first second period.
 With gas producer and power turbine set at sea horsepower and with power turbine speed of not less than 95%, moderately to takeoff power within the second at 6,800 ft, provided the power turbine speed is maintained at 100% at the end of the first second period.

With power turbine speed of 100% and gas producer speed of 50%, synchronous to takeoff power at 30 sec from 6,800 ft to absolute altitude.
 From takeoff power to 6,800 ft, gas producer speed and with power turbine speed maintained at 100% decrease to five second from sea level to 6,800 ft. up to 150 ft. TAS.

Altitude 125 psi \pm 5 psi, and 100% of temperature

- An alt. of 0.71 for takeoff horsepower of 750 on a standard static day at sea level.
- A takeoff alt. of 0.73 for a sea level of 940 ft.
- A normal operation at 213 hp. and a consumption of 0.74 at sea level on a static standard day.
- At 6,800 ft. altitude, 91% takeoff power and 106 hp. and alt. of 0.73 at altitude setting.
- At 8,000 ft., standard sea temperature and 250 hp. at alt. of 0.74.
- Ability to start, stop and operate over the altitude range previously mentioned.
- Accelerated flow to 250 hp. in five seconds and from 250 hp. to idle in five seconds. This has been done on each 50% cycle.

Specification weight for the A-5 engine is 115 lb. The current weight for the 50-lb engine is 137.8 lb. Steps are being taken to have the specification weight changed to 138 lb.
 The engine tested at its base data contained specific fuel consumption at takeoff inlet temperatures of 1,600° of less than 0.67. Project Engineer John M. Wender believes the figure can eventually stand as low as 0.61 lb/hr.

The official 30 lb. PPRF for the A-5 production engine is scheduled for next March. Engines will be delivered to Bell, Hider and Hughes in February. There is June, and sea trials in July and August. The 150 lb. test is scheduled for September. Consequently, design stream of environmental tests and emergency fuel operations will be completed.
 Deliveries of the production A-5 model are due beginning next December for a total of 25 engines at the rate of one per month until April, 1965 when final 25 will be delivered.

In November the FAA performance type certification board met. In addition to compare and FAA representatives, Army, Bell, Hider, Hughes and Air Force officials attended. FAA tests and development efforts are due to begin in December 1962.

At AFSS, base plans are now under way on the T-65 program to an extent to recover the stable engine requirement in the project.

Foundation Records 1,300 Near Misses

Washington-Project Bear, near miss report program conducted by the Flight 50th Foundation has recorded more than 1,300 near miss incidents in the U.S. between July and Sept. 30. In an estimated 74% of the incidents, aircraft were reported within 100 to 500 ft. of each other. Near misses also show that 57% of the aircraft involved were being under positive control.

MANAGEMENT Ideas Advanced to Improve Conventions

The talk entitled "Technical Conventions: Tips for Success in International Conferences" given at the Institute of Radio Engineers Conference on Technical Conventions in Philadelphia, August 1964, was the first of a series of talks on the subject of technical conventions, sponsored by the IEEE, which suggested changes which could make conventions more useful to the technical community.

The technical convention, which could be one of the most effective ways for exchanging information, is generally underappreciated and often neglected. This paper offers some suggestions which might make the technical convention more useful.

The primary objective of a technical convention should be to provide the maximum amount of useful information from the people who have made notable advances in technology in a large group of fellow scientists and the maximum expenditure of time and money. In other words, technical conventions should serve as "information exchange."

Many technical conventions fall far short of this objective, leaving virtual poverty as "a gap" for their sponsors and speakers who have nothing significant to report.

The reasons given for this have been shortcomings in the procedure and lack of coordination and coordination between technical societies and even within a single society, which results in a proliferation of overlapping and duplicate sessions.

Technical societies need to be conducted in a more efficient and effective manner in the technical presentation and exhibit the time of those attending.

Manufacturing Numbers

During the past few years, the number of technical conventions sponsored by the Institute of Radio Engineers (IRE) has increased, usually 50% (AW No. 21, 1960, p. 7).

In the fields of aerospace technology and industry, the number of conventions is increasing by nearly 10% each year. It is a dynamic technology a modern science in the number of conferences it is expected. But the lack of information about conventions between technical societies is between sea power within a single society to state that there is a technical convention. The result is not clear, which makes it impossible for the average engineer to attend more than a fraction of the technical events, even papers on subjects of interest.

Conferences, for example, the field of communications. During the months of May and June, 1964, there were numerous conventions at which papers were discussed on the subject of communications satellites.

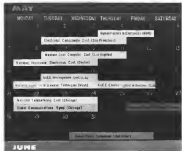
These included:

- May 18-19: National Aerospace Electronics Conference, Dayton, sponsored by the IEEE, Professional Group on Aerospace and Navigation Technology.
- May 21-24: Global Communications Systems Change, sponsored by the IEEE Professional Group on Communications Systems and the American Institute of Electrical Engineers (AIEE).
- May 26-27: Conference on Physical Aspects of Space, sponsored by the IEEE Professional Group on Communications and the National

Aerospace and Space Administration.
 June 11-12: Joint Institute of Aerospace Sciences and Aerospace Research Society Conference, Los Angeles.
 June 20-21: Military Electronics Conference, Washington, sponsored by the Professional Group on Military Electronics.

Convention Attendance

In attend these five conventions an engineer attending in the field of communications technology, should have had a good



Manufacturing Numbers

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | | | | |

TECHNICAL CONVENTION calendar has May and June show overlapping sessions.



Minuteman ICBM underground launching complex at Malmstrom AFB, Great Falls, Mont., consists of 10 launch sites located under surrounding underground vertical shafts (left) and concrete chamber (right). U. S. Army Corps of Engineers directs construction.

Minuteman Complex Being Built at Malmstrom AFB



Reinforcing steel is attached to lower outside hole (left). Abracadabra lower launching tube is placed in hole at right. Concrete will be placed around tube. U. S. Army's American Bridge Division is erecting steel here under contract to Valley Works Company.

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The COAXICON contact line has remarkable depth, for both single and multiple-conductor applications. COAXICON contacts will accommodate the popular sizes of coaxial cables from RG 196/U to RG 62/U having stranded and solid conductors and have a very low VSWR in the KMC ranges when used with cables having a nominal impedance of 50 ohms.

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AMP makes and supplies systems and supplies other defense electronic products. AMP's products are used in defense and space systems.



AVIONICS

Facility Will Assess Nuclear Vulnerability

By Philip J. Kim

Washington—First technical details are a view. Pentagon facility which will explore new techniques for an advanced Department of Defense Damage Assessment Center (DODDAC) were disclosed here at the recent Eastern Joint Computer Conference.

The center is intended to provide the Joint Chiefs of Staff in peacetime with information on the nuclear vulnerability of armed forces and military resources of the U.S., its allies and potential enemies. In event of attack, DODDAC is intended to quickly determine the extent of nuclear damage experienced by friendly forces and resources as well as those of the enemy.

A first generation, semi-autonomous DODDAC equipped with an IBM 1401 computer, located at an underground hardened site, went into operational use last summer.

Development Center

The new DODDAC facility at the Pentagon will serve as a development center for test of more advanced equipment and system concepts for a second generation Damage Assessment Center operational system to be implemented in the future. The new Pentagon facility will also be used for support of Joint Chiefs of Staff war game activities.

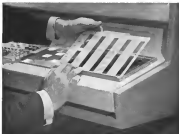
The DODDAC function, created about two years ago, is assigned to the Defense Atomic Support Agency (DASA), a joint services organization headed by Maj. Gen. Robert H. Booth, USA. DASA, which reports to JCS, is an outgrowth of the former Armed Forces Special Weapons Project, which in turn was the successor to the wartime Manhattan Project. Its other functions include responsibilities for conducting individual service requirements for nuclear weapons with the Atomic Energy Commission providing technical backup and assistance in operational tests of nuclear weapons, and disseminating information on nuclear weapon effects to the military services.

The new DODDAC development facility which is nearing completion here represents "a significant advance in large-scale data handling systems" and "one of the more advanced real time systems incorporating on-line interrogation and display." Dr. Walter F. Bauer of Thompson Radio-Woodbury told the computer specialists attending the conference.

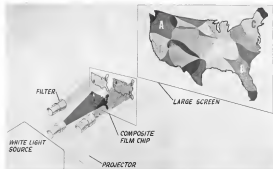
The company is responsible for providing the communication and display



COMPUTER COMMUNICATION console for Department of Defense Damage Assessment Center development facility will enable operators to communicate and interrogate complex CDC 1604 data processing system, consisting of a large control 1604 computer plus two smaller CDC 116 computers.



SIMPLIFICATION of communication console controls is made possible through use of 68 different picture modules, like one shown above, any one of which may be plugged in to alter computer routine and change functions of 36 subroutines on the console.



NEW DEPARTMENT OF DEFENSE Damage detection display under development by Thompson Radio Woodbridge. Full color display will be achieved using this system on black and white film strip.

equipment used in the new installation including a new type of full-color damage-detection display.

The other two major contractors for the facility are System Development Corp., which is responsible for system modeling and programming, and Control Data Corp., which is providing the CDC 1600 data processing system. NASA is acting as system manager, making subcontractors for major elements of the new facility, according to Capt. Scott Latham, USN, deputy chief of staff for damage assessment system.

Velocity of Data

A vast variety of information on total U.S. allied and enemy forces and resources of military interest will be collected, stored and kept updated in the DODDAMC system. For example, information is collected on nuclear forces and their supporting resources, such as nuclear fuel, air bases and support facilities—both mobile and fixed in danger-submarine facilities.

Capt. Latham emphasizes that DODDAMC is not a command and control system, but it will be able to connect into and serve such systems, including the proposed national command and control system. Nor is DODDAMC an intelligence system, although it will exchange information with existing intelligence systems.

The DOD Damage Assessment Center is designed to receive instantaneous

reports from the existing national command system. It will also receive data from the new nuclear detection system (NTDS), known as Nucleon when it is developed and implemented. Nucleon is intended to pinpoint the location and approximate size of any nuclear blast occurring in the U.S. Weather information, which determines nuclear fallout patterns, also will be fed into DODDAMC.

Information on stocks carried by U.S. and allied strategic forces against the enemy also will be supplied to the center.

From such data DODDAMC must quickly calculate and display an assessment of the magnitude and consequences of damage upon the U.S., its allies and the enemy. Such pinpointed assessment will be an estimate of "disputed assets"—the remaining forces and resources coming after attacks by both sides.

The DODDAMC computers must be designed to accept such data as it is received, much of it over a time span of only a few minutes in hours, and to rapidly calculate the effects. The JCS staff must also be able to interrogate the system quickly to extract any of the vast amount of data that is stored there.

The system designed by TRW for communications with the CDC 1600 data processing system is the new damage assessment center is intended to enable

the operator to function effectively in just a few minutes, Latham said.

The console has a conventional alphanumeric keyboard, control buttons and status lights to enable the operator to interrogate the system and select desired operating modes.

Emphasizes Sub-controls

To minimize the number of buttons and controls on the console, the system employs sub-controls which give each display for the console operator on a 10-in. cathode ray tube. For example, if the operator should push an console button requesting an assessment of damage to military installations, the computer automatically displays on the CRT a list of different types of military facilities. In pushing a button to view a nuclear on the CRT, the operator can select the specific type of nuclear.

Another feature intended to reduce the number of control buttons on the console is the use of 60-plate overlay, any one of which can be placed over a bank of 30 control buttons. When a particular overlay is installed, with its particular selection of control options described on the overlay, as prompts on the underside of the overlay automatically select the computer sub-routine for the specific function desired. Its use allows the 30 buttons on the console to provide a total of 1,800 control functions—(60 x 30).

The TRW approach to the design of an on-line group display, which is particularly well suited to DODDAMC, may also find application to other military data processing system studies.

The display uses a 70-mm film clip (dial) which can be projected on a 8 x 10-ft screen. An optical focus of the equipment is that it provides a full color display using black and white film through a special aperture system. The film can be developed through application of heat instead of chemicals in only 15 sec, Latham said.

Background Slides

From a library of previously prepared background slides, such as maps, charts or photographs, the system selects the desired one. Superimposed current situation information generated by the computer and produced as a new composite slide, which it reads for projection within 10 to 60 sec., Latham said. The location of the appropriate background preparation of the new composite slide and projection will automatically be controlled by the DODDAMC data processing system.

The full color display is achieved by creating three separate black and white images on a single slide using three slides. One image is produced by light which passes through a red filter, or other by light passing through a green filter, and the third by light passing through a blue filter.

When the slide is projected, red, green and blue filter glass are used to reconstruct the three images which then are optically combined to achieve full color.

The technique has the added advantage of providing color mixing between the background and the computer-generated information. For example, if the background map is blue and the computer-generated information is red, the result is a brown tint, not a purple tint, which occurs when the background is mixed with the background to form a green tint.

The center's data processing system employs a large CDC 1600 computer also associated input-output equipment. Much of the equipment at the new facility, such as the CDC 1604 system, is being rented to hold down facilities and prevent the use of state-of-the-art equipment when and if it becomes available and needed.

A large random access storage, with a capacity of more than 10 million characters, is provided in a Bostwick 324 drive. It is fed a high-speed transfer which ranges between 35 to 65 k/sec., Latham said. System is designed to permit storage to be increased to 100 million characters.

One of the two small CDC 1600 computers normally serves as an input-output buffer and processor for data entry and hard copy output. The other CDC 1600 system is a time-shared system, serving the large 1604, the

communication console and controlling the processing of data for the large group display. For various types of sample operations, one of the small CDC 1600 machines can be used independently.

The large 1604 machine performs the analysis and retrieval tasks required in the DODDAMC development center, including computation of the damage assessment functions, updating of stored information, and output processing. The machine's master program also controls the scheduling and direction of data flow throughout the system, is sharing the two six-bit 164 machines.

Unusual Aspect

The new DODDAMC is unusual, Latham said, in its ability to adapt the small CDC 1600 computers for both full-size type operations and in computer part work in support of the main data processing operation. The report by Bauer was co-authored by Werner L. Plank, chief of Thompson Radio Woodbridge, Cambridge, Mass.

The new DODDAMC facility, located in the basement of the Pentagon, is intended as a developmental center and its operational use is expected only for prototype. Limited reliability studies are being conducted for damage assessment, Capt. Latham said. It is not intended as a production operational facility, a function which is performed by the present first generation hardened installation.

ICAO May Adopt Improved Landing Aids

Washington—Changes in present international Landing Aids (ILS) standards, to permit use of higher accuracy facilities, have been approved by transport treaty members, will be one of the important subjects considered next month at Montreal at the seventh session of the International Civil Aviation Organization's Conference. This was announced by a spokesman.

The ICAO meeting opens Jan. 9 and is expected to continue until Feb. 7. The conference is not expected to produce the latest conference of the previous meeting two years ago when the U.S. and the United Kingdom both lodged their objection to ICAO-compatible distance measuring equipment (DME) as an international standard.

Delegates from approximately 35 member states including Poland and Czechoslovakia, are expected to attend. The Soviet Union, which is not an ICAO member, has sent an observer to the meeting.

The U.S. delegation will be headed by Dr. P. McKel of the Federal Aviation Agency. McKel is a strong chief

of the System Staff Division at FAA's Aviation Facilities Service.

The present ILS standard standard, which is used by many airports, is considered adequate for most airports and airports and therefore will not be changed as such. However, ICAO will consider the addition of one or possibly two accuracy levels of the standard, incorporating such recent developments as the improved sensitive threshold receiver for implementation and use at high density airports serving air traffic.

New ILS Categories

The new ILS standard categories if adopted, will be operationally compatible with the present standard in that aircraft equipped to use conventional ILS will be able to use the new facilities.

A similar addition to the present VOR (omni-range) navigation aid standard will be considered in terms of the accuracy developed. Display VOR which can be employed as a distance measuring aid when a conventional omni-range station would have excessive error.

Another subject of considerable interest will be aircraft identification (transponder) data link systems. Cooperation between the U.S. and United Kingdom, to resolve differences over what suitable equipment techniques, should be used—differences which arose because the British suggested civil and military air traffic use the U.S. gear. It does not use two countries agreed upon a dual standard of vehicle speed permits.

The link system, international in concept, is being used by the United Kingdom and the U.S. to carry out tests pending approval for both military and civilian operations, which domestic aircraft operating within either country can be certified with a license providing only one equipment mode.

The modernization and new permits which results for international operations will meet very close cooperation mode because new equipment has been developed, but other alternatives. This dual standard agreement type aid because will be proposed as an international standard at the Montreal meeting.

There will be an exchange of views

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let) no attempt to adopt an ICAO standard on the achieved ratio of auto sense altitude (light) reporting on the beam.

The Montreal conference also will consider the possible use for additional VOR and DME channels as a means of providing additional accuracy in high density areas. It appears technically feasible to double the effective number of VOR channels by introducing 90° beamed spacing instead of the present 180° beaming. A similar increase in the available number of DME channels could be obtained by adopting a second pulse coding arrangement for subchannel of the DME ground station and for the receiver.

The ICAO conference will consider the desirability of this approach, which would require modification, or in some instances replacement, of existing ground and airborne equipment.

An alternative way to provide additional accuracy without channel splitting which may be considered is the use of all course-computing and pretimed displays.

Channel Splitting

The consequences of channel splitting are most acute for the U. S. because of the large number of private firms who strongly oppose changes that force replacement of their existing communication/navigation equipment.

Another item on the ICAO agenda is the question of establishing acceptable minimum performance specifications for airborne communication and navigation equipment as an international standard. Because of the relatively few small private firms specified in most ICAO member states, there is expected to be considerable support for such a move. But the U. S. is expected to seek stand alone which are not incompatible with the desirable needs of private aviation. Long-distance navigation aids are scheduled as an "exchangeable" item on the Montreal agenda, to be discussed in the next year with a special ICAO meeting to consider adoption of an international standard.

Doppler Reference

The U. S. delegation is expected to indicate a preference for Doppler radar, which is finding increased use in coastal navigation operations, when used with a suitable automatic integration computer and an accurate gyro heading reference, rather than a new ground-based system.

When future position fixes or fix lights are used to periodically correct a Doppler navigation system, it can provide satisfactory service as a long-distance navigation aid, with no new investment in ground facilities, the U. S. delegation is expected to stress.

But when ICAO delegates exchange

views on the possible use of a Doppler navigation system as a short distance navigation aid, the U. S. delegation is expected to voice doubts over the benefits, particularly in high-density littoral areas.

Although the U. S. Air Force has been a pioneer in the application of single sideband techniques to long-range high frequency communication links, particularly for ground-to-air communications, the U. S. delegation is not expected to strongly urge the adoption of single sideband (SSB) as an international standard.

Current thinking is that the use of very high frequencies (VHF) throughout the world, which nearly doubles the overall line-of-sight range of VHF, may be a better solution to present HF radio communication channel congestion over the North Atlantic. The technique was pioneered for ground-to-air use in the Pan American World Airways, and the Federal Aviation Agency currently is studying two additional in-flight stations which should provide secure continuous VHF coverage of the North Atlantic enroute routes.

FILTER CENTER

USAF to Develop Next-Gen Automated Systems Division is seeking negotiators with capabilities of analyzing and demonstrating feasibility of a nuclear power using nuclear area phenomena in basic reference. Space Group scope Co., which has been conducting nuclear power investigations with companies, is one of several companies expected to submit proposals. Interested parties (companies) should contact G. P. Anon, Wright Patterson AFB, Dayton, Ohio. Offer opening ASD requests for proposal for scientific research and development include:

- **Control Mechanisms:** Study of basic mechanisms and processes of living systems, sensory, adaptive filtering and neural processes for possible application to Air Force communication systems needs. Address briefing conference is scheduled for Jan. 5. RFP 35-07-62-31574-01 Cont. ASK7PDC, CL-3-7111, Ext. 1-1356.
- **Redundancy:** Addressing necessary device research and development on memory device capable of performing both storage and logical functions within itself for use in fault tolerant systems. RFP 35-07-62-31574-01 Cont. ASK7PDC, CL-3-7111, Ext. 1-1356.

USAF Official Waste Industry-Air Force: presently is seeking reliable means for identifying the commercially efficient contractors to which they may be awarded appropriately and to detect

the commercially inefficient contractors so that they may take advantage with them. Maj. Gen. Kenneth P. Bergquist, Air Force Electronic Systems Division commander, visited at recent Group meeting of Armed Forces Civil Contractors Association.

Army Plans Active Thin-Film Program—Research and development program aimed at developing thin-film active elements in areas of spectral characteristics of silicon or polycrystalline substrate surface is planned by Army Signal Corps. Industry proposals are due early in January.

Increased Radar Sales Predicted—Market for radar, shipboard and airborne radar, currently estimated at approximately \$746 million annually, is expected to increase by some 10% to approximately \$1,135 million by 1970, according to predictions made at recent Electronics Industries Association conference in Los Angeles. Sales of heavy surface radar currently running at annual volume of about \$500 million, are expected to reach \$771 million by 1974. A 31 Stage of Radar Corp. of America and Incoated sales for ICBM defense and space radar have will be responsible for majority of the anticipated gain. Shipboard radar sales are expected to increase from \$110 million to \$149 million in 1976, as, according to Clifford A. Boren of Bendix. Sales of airborne radar for manned aircraft and drones, currently running at \$137 million level, are expected to decline to about \$82.5 million in 1976. By 1976, then, sales to \$135 million by Ford 1970, according to prediction by G. P. Fige of Motorola.

Scientific Study Governmental Wave-Two Soviet scientists recently proposed an experiment which might permit detection of gravitational waves. Tachyon motion: one of two groups of 10,000 identical, closely packed parallel cylinders which would be coated to oscillate at a frequency of about 10 cps. A shift in the phase of oscillation of one group of cylinders is expected to cause a synchronous change of gravitational radiation emitted by the other. This would result in a modulation effect which could be detected by measuring the amplitude of the voltage across both groups of cylinders simultaneously. Details of the proposed experiment are described in an article by V. B. Buzga and G. I. Rokanov in the Zhurnal Eksperimental'noy i teoreticheskoy fiziki, Vol. 41, No. 1 (7), 1961, p. 104.

Collins Plans Emergency Service Center—A new customer emergency service center, which will remain open 24 hours per day, 365 days a year to provide immediate response to military/

commercial customer problems, has been established by Collins Radio Co. at its Cedar Rapids, Iowa headquarters.

Conventional AIDN—Automatic data exchange system which enables storage of various reports and information ranging from 60 word per minute, independently to thousands of bits per second data channel facility, has been developed for commercial use by ITT System Division, Patuxent, N. J. System automatically routes messages, establishes message priority, stores messages when receiving channel is in use and controls data speed and code differences between transmitting and receiving equipment.

Physiological Data Transmission—Marine radio transmitters for implanting in living animals will be designed for the Air Force School of Aerospace Medicine by RFI Communications Associates, Inc., Rochester, N. Y. Devices powered by self-contained batteries and insulated by hermetic potentials, will provide telemetry equipment in space vehicles with continuous data on heartbeat, blood pressure, temperature and other physiological parameters for periods up to 30 days.

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MASON SEATS, ordered by Continental Airlines and being evaluated by both American and TWA, have cushions glued to Mylar plastic shell and covered with removable covers. The manufacturer claims maintenance savings of more than 50% over conventional seats are possible. Integral table is of plastic foam construction. Photo at left shows American's contribution for night tests

Lightweight Seat Evaluated by Airlines

Mixed passenger reaction to the new Mason Seat evoked by Continental Airlines for high density configurations has resulted from inflight evaluations of the seat by two other airlines.

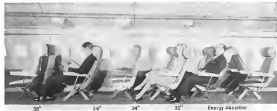
The seat, manufactured by TECO, Inc., is designed to be rugged, firm in position, and lighter than conventional seats and to allow lighter density cabin seating to increase carrier revenues. TECO is a California company that builds conventional airline seats. The

new seat was developed by E. Gilbert Mason, president of TECO.

It is of modular construction with monocoque plastic shells externally buttressed with plastic foam and aluminum structure. Armrests, shells and legs fit into an aluminum support tube and are adjustable along the length of the tube. The contoured shell allows thoracic cushioning and is reinforced to permit 4- to 5-in. space saving between rows of seats.

A firm order for the Mason seats has been placed by Continental Airlines, for use in its 141-seater economy coach service at times about 25% lower than present jet coach fares (AW Nov. 6, p. 37). Continental's application to provide this service has been accepted by Civil Aeronautics Board pending its certification. It was to have been effective Dec. 1.

There is some uncertainty about the use of Continental's order. The airline



MOCKUP OF AIRLINER INTERIOR by TECO shows how spacing between rows of seats may be varied. Seating spacing between rows, wing-fitted space differences, height both vessel reactions in American Airlines flight tests. Passenger complaints traded to account in space between rows decreased. Note energy absorption action of seat on row at right.

has announced the purchase of 175 seats, but some reports place the order higher. Continental will not discuss its commitment beyond the announced 175. The airline planned to equip five Boeing 707-120s with the seats, providing 75 economy jet seats per airplane, plus 16 regular club class seats and 44 first class seats of conventional design. The Mason seats would be spaced at a 32-in. pitch.

American Airlines and Trans World Airlines, both of which opposed the Continental bid but filed for a remedy to meet the competition, have set their own evaluations of the seats. In both cases these involved tests on actual scheduled flights with surveys of passenger reaction. Continental planned various other tests of the service, but has not tested single to six.

American and TWA report mixed passenger reaction to the seats. The results still are being evaluated.

TECO and the seat weighs 26 lb compared with 31 lb for a standard coach seat. First class seats are about 50 lb, or more. With an all-Mason configuration accommodating 158 people in a 707, the weight would total about 390 lb more than standard seats for 80 coach and 40 first class, according to TECO.

The Mason Seat is said to have many maintenance advantages. It has only 70 parts versus about 600 for a standard seat. Checkups, which are attached to the shell by adhesive and can be peeled off, have removable covers. The Mylar plastic shells can easily be cleaned with soap and water, according to TECO. Legs are quickly detachable from support tubes. The legs are aluminum forgings with which screw seat caps. The manufacturer says some insurance cost savings of more than 50% are possible with the new seat.

Leg covers are unfastened and there is an 8-in. provision for under-seat storage of baggage. The seats' headrests rotate free and tilt and are adjustable in three reared positions. Integral table is of plastic foam construction. A continuous lever along the structure allows unlimited adjustment of shell, armrest and leg components.

From a safety standpoint, the seat has successfully been tested to Air Transport Panel standards. It features an energy-absorbing device which dissipates energy by the deformation of steel as the seat rotates through 61 deg. Tests are said to have been made at 10 g at 65 mph and 20 g at 50 mph.

The manufacturer will be making drawings of the seat after great flexibility for installation in various types of aircraft. Parts are interchangeable in single, double and triple seat configurations.

Cost of the Mason Seat is about \$3,200 for a triple version. This is said to compare with \$5,500 for the last expensive conventional seat with arm and leg. The seat is said to be a double double-seat unit used in Douglas DC-8s.

In its evaluation of the seats, TWA installed two rows of three seats each on the right hand side of a 707. Passenger seat space questionnaires. Two test programs of about 90 days each recently were completed. Results of the survey are still being evaluated, but indications are that public reaction was mixed.

American also recently completed its testing, which lasted about a month. These rows of six seats each were installed on a 720B and passengers received questionnaires. Passengers in standard seats also were queried. Spacing was varied, starting at 37 in., moving down to 35 in., 34 in., 32 in.

As spacing decreased, American flight complaints increased. Whereas reaction generally was favorable at the greater spacing, when spacing was reduced people began complaining about items that hardly bothered them before, according to the airline. There was some resistance to the striding of the seats, which are of striking contemporary design equipped with the cup, ventral rest and apparently don't appeal to people with conservative tastes.

Generally, American found that the conventional seats lasted better than the Mason seats in fat service.

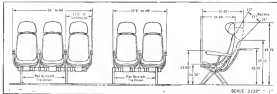
As a result of the inflight tests serving try suggestions on the seats have been modified to overcome a mobility. No other changes have been made. The seating problem was known to TECO, the firm had not been accomplished before the installation.

Except in the airline version, the Mason seats surface. A lock on the reclining position is available in the standard in an option. In the standard version, a space dampener is included. Continental has elected to buy the seats without a reclining lock gun.

The seats also are being tested by Greyhound Bus Co., which is equipping two buses with 15 seats each.

Other Mason seat projects now in the works include a seat with leg rest for coach class seating a 41-in. pitch, and a triple seat with a removable center seat which can be converted to a table with the armrest removed. This can be done by the passenger in the event the cabin is not full.

Mason also is considering a plan to lease seats to airlines through a leasing company. This would involve taking a neutral color scheme to fit, with interior color changes varied by different airlines.



SEAT DIMENSIONS AND SPACING show differences from conventional seat spacing. The seats rotate forward through 62 deg

DOD Lists Top 100 Contractors in 1961

The 100 companies and their subsidiaries are:

[illegible][illegible]

| Company | Millions of Dollars | Percent of Total |
|--|---------------------|------------------|
| 60 SECOND SOURCE OIL Petrochemicals & more Oils | 41.2 | 0.4 |
| Total | 41.2 | 0.4 |
| 61 CHEM. BATHING CHEMICALS Liquor; Toilet Deodorants | 38.9 | 0.4 |
| Total | 38.9 | 0.4 |
| 62 K&M, INC. | 28.2 | 0.3 |
| 63 LLOYD TRADING TRADING Auto Lending | 0.3 | 0.0 |
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| Total | 0.9 | 0.0 |
| 96 ROBERTSON-ROBINSON ROBERTSON-ROBINSON ROBERTSON-ROBINSON | 0.9 | 0.0 |
| Total | 0.9 | 0.0 |
| 97 ROBERTSON-ROBINSON ROBERTSON-ROBINSON ROBERTSON-ROBINSON | 0.9 | 0.0 |
| Total | 0.9 | 0.0 |
| 98 ROBERTSON-ROBINSON ROBERTSON-ROBINSON ROBERTSON-ROBINSON | 0.9 | 0.0 |
| Total | 0.9 | 0.0 |
| 99 ROBERTSON-ROBINSON ROBERTSON-ROBINSON ROBERTSON-ROBINSON | 0.9 | 0.0 |
| Total | 0.9 | 0.0 |
| 100 ROBERTSON-ROBINSON ROBERTSON-ROBINSON ROBERTSON-ROBINSON | 0.9 | 0.0 |
| Total | 0.9 | 0.0 |

[illegible]



CESSNA 192 MODEL 310G has new design tip tanks to provide better lateral stability characteristics for the aircraft.

Price Cut on 1962 Cessna Model 310G

Improved light characteristics through complete redesign of wingtip tanks is a major feature of Cessna's 1962 Model 310G light-twin business plane. New tip tanks are thinner and are mounted flush to the bottom of the wings.

They are coated around 35 deg. provide a desired effect that, in one direction with a change of stability radius from -1 deg. 45 min. to zero, improves the aircraft's lateral stability characteristics and permits holding headings or making course corrections utilizing only rudder.

Cessna this year has instituted a big national price reduction on the base 310G, which lists for \$99,950—a cut of \$2,550 from the price of last year's model 310F. Indications are that the price reduction was to establish a wider

gap between this airplane and the new supercharged Model 330 Skylight, which lists at \$69,950.

The new Model 310G will be formally unveiled to the public around the country, as dealers showings Feb. 3.

The airplane's new tip tanks have flush-mounted filler caps and a new drain valve and side-mounted boost pump are fitted. Tip tanks retain standard capacity of 102 gal. total at lower tanks, with optional additional fuel tanks totaling 133 gal. also being available as formerly. Powerplants are the same Continental twin-cylinder fuel-injection 105-470-D engines as in the 310F, rated at 240 hp at 2,625 rpm.

The airplane's landing gear also has undergone changes to provide softer ground touchdown and ground handling

characteristics. An extension of the main gear shock struts has been altered to increase the air cushion in the compression condition doubling shock's cushion capacity. The compression struts bearings have been modified to reduce friction and nose gear is fitted with a new bar having improved deflection and better load-carrying ability. The pressure on the main gear have been increased to 50 psi.

Model 310G's gross weight is 4,990 lb., compared with a maximum gross weight of 4,816 lb. for the 1961 Model 310F. With the increase in weight, useful load is up 175 lb. The new gross weight approximates that of the USAF's T-41 version of the 310. Cessna notes that the Model 310G retains all of the standard equipment provided with last



NEW 310G IS REPORTED TO CRUISE at 215 mph, at 75% power at 6,500 ft. Top speed is given by Cessna as 240 mph at sea level.

year's Model 310F and that 10 choices of complete paint schemes are again available on the new model. In addition to standard equipment, the 310G offers six groups of factory or dealer-installed electronic optional equipment, starting at \$1,465, installed in Wichita. A Motorola L-2 autopilot is also available at factory installed equipment at \$4,295 and for \$890 additional an altitude hold control can be installed.

Restart Changes

Changes have resulted in more specific criteria and performance numbers for last year's model, although speed and range data provided by Cessna on the new airplane is based on different power settings and altitudes. For example data on last year's Model 310F is based on 70% power, similar data on the Model 310G is based on use of 77% power.

For the Model 310G, top speed at sea level is given as 240 mph, while the Model 310F was given as 247 mph. Cruise speed for the new airplane at 6,500 ft. and 75% power is stated to be 215 mph, compared with the 310F's 220 mph at 2,000 ft. on about 70% power.

Altitude's Range

Range, an 800 yd., average seaward from altitude for the 310G at 75% power at 6,500 ft., is stated to be 790 mi., compared with the 310F's 825 mi. on 70% power at 5,800 ft. With 350 gal. the 310G's range at the same power and altitude (75% power and 6,500 ft.) is stated to be 1,015 mi. compared with 1,070 mi. at 70% power at 5,800 ft. for the 310F. Range is figured with one pilot. Allowance for fuel reserve.

Rate of climb on two engines is given

at 1,790 fpm for the Model 310G compared with 1,660 fpm for the 1961 Model 310F. Single-engine climb rate for the two engines is 400 fpm and 440 fpm, respectively.

15-foot ground run for the Model 310G over a 50 ft. obstacle is 1,470 ft., 75 ft. less than the 310F's engine and landing distance over a similar obstacle is 1,770 ft., an increase of 50 ft. over the Model 310F. The new airplane's height increases in wing and power handling due to a slight increase. Wing loading now is 25.1 psf and power loading is 9.6 hp/psf.

Dimensions of the two models remain constant, the same except that the new control cut tip tanks on the Model 310G increase wing span from 35 ft. to 35 ft. 11 in.

Standard seating comprises two front individual seats and a three-place rear seat.

Optional, in addition to two front seats, are two rear individual reclining seats for \$785 extra, two adjustable rear seats at \$701 extra, a five seat configuration with three rear individual seats at \$941 extra, and a five place version with a single adjustable rear seat and a two place lounge for \$622 extra.



TIEE PARASITE HAS BEEN INCREASED to 18 psi on main gear wheels and the nose gear has a new tire for better lateral steering ability and improved deflection. Landing gear has been redesigned to give softer touchdown characteristics.



SIX-PLACE CABIN ARRANGEMENT provides each occupant with an individual seat. Four front seats have folding outboard armrests either in standard or optional equipment.



POTEZ 840 turboprop transport's nose section is designed for good visibility. This is a No. 1 prototype.

Aviation Week Pilot Report:

Potez 840 Has Automatic Throttling

By Herbert J. Coleman

Potez 840 four-engine turboprop transport, a highly maneuverable, rugged French entry into the world's feeder lines and executive market, will undergo major modifications to make it more attractive to North and South American buyers.

With more than 150 hrs. of flight test time on No. 1 prototype, the No. 2 airplane, now more than half completed, is being fitted with an entirely new nose section designed to take a Collins weather vane; an additional cockpit window, already good, is being

exposed, by extending side windows farther forward.

These items for the changes, according to Jacques Gaspette, chief test pilot, is simply to meet what has become primarily North American requirements for safety, since weather vane has not been widely adapted for small European transports.

In addition, Potez is pushing the airplane strongly, as a five-engine replacement. Weather vane is a necessity for the use, and the added cockpit visibility will appeal to pilots.

No. 2 Potez 840 will be flown to the U.S. next year, when the sales agent,

Terbo Flight, Inc., of Chicago, will start demonstrations soon. Airplane will be sent to Terbo Flight, which is negotiating orders for 34 more airplanes from Potez, including the modifications, is planned to be about \$500,000 (447 pgs) in the U.S. (AOW May 25, p. 71).

At present, production is geared to four Potez 840s—the No. 2 prototype now flying. No. 2 modified by U.S. transportation is third demonstrator to build up time and a fourth for state testing in electronics, according to Pierre Camille, chief of flight test.

With the exception of one landing accident that put the plane out of commission for about a month, the test program has been highly successful, and the designers have in use no major modifications in the metal structure or engine, made from the usual aluminum alloys joining.

Production Plans

The company still plans to set up as 545 production line, near Gales, France, where Potez has manufacturing facilities, despite a marked lack of enthusiasm from the French government.

The main reason for the move is to keep the price at \$150,000 level, according to General Potez, company president and secretary and son of founder Jean Potez. The turboprop plane has been widely tested by Potez, since previous model had been shown at the Max Hahn Super Research.

General Potez said production facilities could be quickly situated, and labor requirements filled by Eric machine and key personnel from the British aviation



VERTICAL PROMIS on each engine nozzle were installed to collect short mode data from propeller surface.

industry, who would be attracted to the move. Most could be as loose trained with little problems, he added.

If enough orders are forthcoming—and Potez officials are optimistic about the world-wide potential for what they believe is certainly an aircraft without a competitor—a last one could be established at Argenteuil, where the Potez-840s Magister jet is in production.

Companysuch has not been in important design requirement, although the modification for North and South American sales can be expected to cause some price rise. Potez feels the market is heavily split by the airplane's introduction, and hence is pushing it hard as a five-engine replacement, along with its obvious attractions in an executive five-engine.

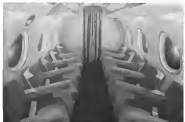
Thus the company's first test is fitted with 24 back-inhabited ports, slightly angled inward, in which the propeller would be each other across the center axis. Another version proposed is for 16 ports forward facing, for fast data from each.

One suggested sales area is as a multi-ton transport and/or freighter, and a number of high-ranking NATO officials have flown the airplane for evaluation of this idea. Ten that carries Potez 840s test program out of Villeneuve Airport, home base of GLAM, the French Air Force VIP transport center, and has been proposed of the world's air forces get a first-hand look at the 840.

Airplane (PW201) was flown by the Aviation Week pilot from Villeneuve-Mrs. with Chief Pilot Gaspette. Also aboard were Camille, two Potez test technicians to record data, and two West German, Claus Kuhl, managing director of Deutsche Taubflug GmbH,



POWERPLANTS for the Potez 840 are four Turbomeca Astrom turboprop engines rated at 1524 hp. Main landing gear retract into wing. Wing door is in clamshell style called Nodol A-7 which is 575 in. back of wing root and opens to 139 in. at tip.



NOCKUP of Potez 840 shows high-density wing configuration for feeder-line operations. Seats are slightly angled for better leg room, aircraft would have 24-passenger capacity.



HEIGHT of the Pote 540 is 27 ft 8 in. Wing area is 377 sq ft. Aspect ratio of the wing is 20.75. Main gear struts sweepback into the wing, wingtips extremely forward.

and his chief pilot, Bill Stepp, a former C-47 pilot.

"Weather was poor and had gone to absolute minimum of 300 ft and 1 mi, with further deteriorations later. Thus, ground instructions were kept to a minimum to best the lowering order."

The Williamson inspection is basic, a visual check of the engine, control surfaces, engine and fuel tank bearings and propeller, and the Mercury landing gear track configuration on the prototype changes constantly, depending on current instrumentation needs for test equipment. During the flight eight stars were fitted on the air badges, with test equipment lowered.

The fuselage is cylindrical and seats are mounted being forward on steps at external bulkhead, to allow a line out and backwash which is not adequate for a six foot man. Main wing spar runs square through the cabin, resulting in a floor beam of about 1 ft high in the cabin fuselage. The cabin and cockpit are well supported and using ground and a single tablet is mounted at the entrance; all service near the baggage compartment.

The cockpit is main but sufficiently narrow for a full pilot. Test equipment is of components, and functions display of instruments and controls, which are bleed for the visual use. Control wheel is U-shaped mounted a bit higher than a standard main on similar planes, which is about opposite pilot's chest.

A striking feature is high concentration of electronic equipment—the Pote 540 is a production airplane on the full scale, including a button which gives automatic throttling, and a Low LIFE light detector system for auto lock-in to VOR radio and ILS system.

Starting Procedure

Engine start sequence is automatic, with warning lights to guard against false or hot starts. Control buttons are

located on center console section. Start sequence takes over using a flat light the airplane's battery, when pitch control lever was set to "run pitch" and throttle moved to start position manually. At this position, hands control the throttle opens a fuel flow control for maximum amount needed to start the engine.

Power of the four Astoria is determined at a constant speed by the propeller pitch, and the pitch lever is the engine control used by the pilot to gain variations in power and speed. For instance, in a dive, throttle will automatically adjust to guard against overspeed, and will advance when the 540 is put into a climb angle.

Pitch Limiting Device

To guard against engine overloading beyond its limits Pote has installed a pitch limiting device in the center Astoria turbine nacelle two compression-ratio stall and the other centrifugal stall chamber with a set point position three step and flow turbine and exhaust device. Maximum power load gives unit speed of 43,500 rpm. The four engines develop a total of 1,002 hp on takeoff. The engines are water-cooled.

Checklist includes setting of the horn control by an electrical trim control on the main pedestal, using a predetermined center of gravity position. The control extension is divided into percentages; if 35 percent were about, fuel could be set at 25%. Above and under trim controls are electrically-actuated by wheels on the pedestal, and the electronic control is an electrical tab on the control wheel, which also includes a Low altitude cutoff by feeding to full down.

With No 1 engine burning over, power is switched from the center maximum fuel lever to out of fuel generation, two switches are used.

one in the nose and the other aft of the pilot, and control levers are mounted on reel over the pilot.

While waiting start light, pilot also immediately checks the engine time for a maximum of 450 deg, and type gases for proper rates. The starter then cuts out at 475 rpm. Pitch control is set to 100% propeller pitch when it usually means, for the rest of the flight, except for the usual adjustments to prevailing conditions.

Down nose section makes forward visibility excellent for taxiing and take-off, as well as controlled by light tips on rubber brake pedals. Visibility control cleared on to runway 35 where we held for fuel island clearance.

Initial approval was to take off, climb to 2,500 ft and hold a heading of 270 deg until further notice. Engines were held at throttle up to 10,000 rpm, then selected for takeoff. The nose was rotated at about 50 ft, and climbout was at 95 ft, giving a climb angle of about 10 deg, to reach the 2,500 ft altitude at once as possible. On this climbout, a fuel flow control is automatically set to about 100 ft, and the engine is set to about 50 ft.

The flight light, was closed by Del control to a constant position, and climb to 11,000 ft, backing into the nose at about 100 ft, and the engine is set to about 50 ft.

At all times, power, speed, and the engine is set to about 50 ft, and the engine is set to about 50 ft, and the engine is set to about 50 ft.

The Pote 540 has definite lighter lift handling qualities, despite but not overly sensitive. The engine is set to handle in step terms, up to 40 deg on the light, and the tailfin can be repositioned to level flight without the main fueling across the horizontal plane fuselage when moving from such manual attitude 30° as shown in the photo, the vertical roller a large roll, at 500 speed, a fairly good select the pilot wheel to lighten a turn.

At level flight, the 540 turned out quickly to a 20 ft, indicated cruise speed. Airplane is set fitted with an outside air temperature gauge, which is included in official engine test gear, but ground speed worked out to be less than 300 mph.

Emergency Procedures

Because of the weather difficulties, and rendering the 540 is a fairly new airplane, emergency procedure testing was held in the nose. However, Gaspari featured No 1 and 2 re-

glass, by simply rotating the two propeller switches and cutting the fuel.

The effect on controls was negligible. Immediate reaction was a drop in speed to about 170 ft indicated and wing was pulled up with only slight down turn. The 540 was put into about a 30 deg bank into the good engine, with no trouble, and rolled out easily. Control was almost as good as a sharp turn, about 20-30 deg into the dead engine, and despite the expected sluggishness on recovery, the airplane returned to level flight rapidly.

By the time about 1 hr 40 min after takeoff, Williamson was below maximum and Gaspari was given the option of One Airport as Gaspari Air Force Test Center for a GCATIS landing. He chose the latter because of available bridge space.

Until the final approach, most of the propeller work was automatic, using the push button throttling control and the Low LIFE system to lock onto Mustang VOR. Weather was about 400 ft ceiling and 1 mi visibility, and ground was down at about 100 ft, and the engine was set to about 50 ft, and the engine is set to about 50 ft.

Cabin Configuration

The Pote 540 cabin is cylindrical, 35 ft long, with 14 windows, seven on each side. Baggage hold has a volume of 65 cu ft. Wing is straight tapered type having an aspect ratio of 10.75 and of full-scale monoplane construction. Deaerolated flap are electrically controlled. Wing is fuselage assembly, a few joints, also tapered from 50 ft to 1/2nd in, and is stiffened by six integral fuel tanks hold 466 U.S. gal.

Fuel system of each engine is independent of the other three, although

a combined allows any two systems to be joined. Each engine includes two integral fuel tanks, one equipped with pump to which draws by gravity into the second tank. Both are vented by a plunger to provide space for expansion, and a ball valve prevents fuel sump.

Wing and tail roots are equipped with de-ice boots, heated to the leading edge, and inflated by a heated air source. Pilot's windshield is heated by electricity, and accumulated snow is swept away by hot air blast.

Hydraulic System

Hydraulic system includes two self-regulating pumps, driven by No 1 and 2 engines, to provide 3,000 psi up to pressure. Control valve selects each pump in case of fan, and a hand pump, located at pilot's right, is available for emergency lowering of the tricycle landing gear. Baking is normally accomplished by depressing the master pedal, although an emergency brake is incorporated in the parking brake.

Electrical system includes an auto starter generator, rated producing 2,200 watt per sec, and down to the turbo-prop. Battery supplies 28 v dc current. Radio equipment on the prototype is a Collins package, including a VOR receiver, plus an emergency VOR, a radio compass which can operate on preselected channels, VOR indicator with master beam, and a radio altimeter operating to 2,000 ft above the ground. The Low LIFE system consists of a light detector, gear sensors, engine and fuel flow, integrated with the Low altitude to allow acting up an automatic landing program.

Pote currently is refining its visual aids operation, based on a successful operation set up for the Magister, in which the company will study the customer's emergency training course and distribute technical information.



CT-20 TARGET DRONE SIX RECOVERABLE FLIGHTS



Nord's CT-20 is zero length launched and radio controlled.

Three drones have averaged six flights, recoverable in the sea as well as on land. Simplicity of design and operation, plus maximum reuse, represent cost savings.

MAIN CHARACTERISTICS

| | |
|----------------------|---------------|
| Speed at 32,000 ft. | 560 m.p.h. |
| Time to 32,000 ft. | 6 min. |
| Mean endurance | 45 min. |
| Service ceiling | 40,000 ft. |
| Take-off weight | 1,470 lbs. |
| Span | 11.15 ft. |
| Length | 17.71 ft. |
| Distance of fuselage | 2.16 ft. |
| Wing area | 34.34 sq. ft. |



NORD AVIATION
3-11, rue Bergeron
CHATELAIN-BOULEVARD
(Seine) France



FORWARD visibility during testing is good, due to Pote 540's dropped nose. Engines are started electrically from external source or from aircraft's batteries.



PAWNEE 335-HP specialized light plane carries 150-hp model's bare structure except for some strengthening to handle 600-lb increase in gross weight. Prototype shown is fitted with experimental engine cooling, being tested to study cooling effects.

Upgraded Pawnee to Supplement Older Type

By Erwin J. Bolton

Vero Beach, Fla.—Boeing practitioners of the agricultural airplane market in the air of a new model of the Piper PA-25 Pawnee featuring increased horsepower and gross weight over the earlier version.

The new PA-25-235, which will be available later this year, will supplement rather than replace the current 150-hp Pawnee, providing additional payload and altitude performance for those operators who need these characteristics.

With development of the 235-hp model, the company's research and development center here has engineered maximum improvements on the 150-hp airplane, which are incorporated in the new powerplant system.

The 235-hp Pawnee is basically similar to the 150-hp version externally.



FORWARD SKEWED leading edges, aimed at reducing mid-buffeting near the stall, will be available in kit form, as optional equipment in the Pawnee.

The prime difference being in strengthening the structure to take the additional power and the higher gross weight, which is 2,900 lb compared with the lower-powered airplane's 2,350 lb. The same 33-in.-dia. four-cylinder diesel engine is installed in both aircraft, but the higher power engine permits filling it to the limit of 1,200 lb capacity, whereas the light limit with 150-hp is 800 lb.

Emphasis on the new version is the two-bladed Lycoming O-540-B engine to the engine used in the 150-hp. Cowling, fuel tank, battery, plane, but fitted with lower-compression pistons to permit use of more readily available and lower cost 50 weight fuel.

With this engine, the Pawnee 235 is about 15 mph faster than the 150-hp model and ground run is approximately 100 ft. longer due to higher wing loading at gross weight. But the climb speed is approximately 650 fpm, or about 25% more than the light-powered airplane. It will clear a 50-ft obstacle at approximately the same distance—about 1,375 ft.

Cooperative Testing

To provide some measure of the two airplanes' cooperative performance as a hybrid gray chemical application machine, a requirement of 1 gal./acre on a field having moist soil of one-third-inch long and wide 40 ft. north-south was completed by Piper engineers. Tests developed at four miles from the field to be sprayed and the leading edge where chemical loading is limited is included.

Average operating speed of the 235-hp Pawnee would be 95 mph compared with the 150-hp version's 85 mph. Including a loading time of five minutes for 1,100 gal. on the acre airplane equipped with four nozzles for the 150-hp model, and considering 30 deg. banked turns during application, the high-powered airplane could accomplish the mission at the rate of 75 acres per hour compared with 60 acres for the 150-hp Pawnee.

Quartering tests, allowing a tolerance of 100 ft. per sec and a pilot weight of 160 lb, per hour would result 514 ft/hr for the Pawnee 235 as compared with



AIR INLET in wing top above wheelshield provides improved, controlled swept-on system, reduces forward air resistance at side of cockpit.

511 ft/hr for the Pawnee 150, with cost per acre figured at 17¢/hr for the former type and 32¢/hr for the latter. Data does not consider cost of ground equipment labor for loading airplane and leaving three to job.

Design Changes

Among the basic improvements in the Pawnee design are strengthening of the airplane's rear fuselage structure, including tail post and longerons, to handle loads imposed when the tail is screech along ground while the airplane is maneuvered on rough ground. The steel wing lift struts are now steel reinforced prior to painting to resist corrosion. The handle for locking the shoulder harness straps and has been relocated from the floor to a position in the seat frame where it is easier to reach and is more rigidly attached.

Main wing hinge fittings have been changed from forged aluminum alloy to forged steel alloy having greater bearing strength—Piper notes that there has been some evidence of hole elongation in some of the aluminum alloy fittings after hard service and the company recommends that these be replaced by the newer type.

Spray Equipment

Spray equipment improvements in their moving the plumbing outside the structure to provide easier checking of its condition and maintenance, changing from brass nozzles to alloy type which are lighter and more corrosion resistant and mounting spray pump with a quick-release bracket for easier change from spray to dust machine.



SPRAY SYSTEM lines are mounted externally on new Pawnee to simplify checking and maintenance. Spray pump and hoses are of quick-detach type permitting conversion to dusting operation in 10 min.



Champion to Market Lancer Twin in 1962

Champion Aircraft now light twin the Lancer, is expected to be certified in early 1962. The aircraft is powered by two Continental 8200 engines rated at 100 hp at 2,350 rpm. Two persons are seated in tandem configuration. The Lancer will have a top speed of 125 mph and will cruise at 115 mph.

Quick change toggle clamps are also used on the dust spreader for the dust pump.

The Pawnee hopper agitator mechanism, which starts up the dust for smoother flow, was designed for a tapered ground bearing which is patented the dust pump hopper. The bearing was affected by corrosion and has been replaced by a glass seal with Teflon packing which serves both as a bearing and seal and which has improved life. Control mechanism for the hopper gate has been redesigned to make it easier to set the desired gate opening and provide the pilot with an exact indication of the amount of opening. Control valve in the hopper which provides

side swirl pattern now are of thicker and harder material to better resist abrasive effect of flying materials.

Cockpit ventilation is improved by a canopy type inlet at the top of the canopy above the windshield, permitting not only considerably greater air flow but better control of amount and direction of flow through the cockpit. Engine exhaust (pipe emerges from the right side of the cockpit, just above wing level where exhaust flow will not interfere with dust disposal).

Piper also has designed, as optional, a spray loading system having a filler cock located on the side of the fuselage behind the wing trailing edge to provide lead for leading to climb on the airplane, and will have to load the hopper tank in front of the cockpit, thus permitting possibility that highly toxic and corrosive chemicals could drip over the structure as man along the fuselage into the cockpit. Higher output system is also available, capable of depressing up to 15 gal./acre with a 40-ft. swath.

PRIVATE LINES

Arco Commodore, Inc., has control factors, service center in Billings, Okla., so handle all factory modifications, modifications and repairs on Arco Commodore. This work formerly was performed by, putting the aircraft to be modified back on the production line. Ray Gardner, former supervisor of field service for the company, has been named manager of the center.

FD-608, 140-hp turboprop transport to be produced jointly by the Douglas Aircraft Co. and Piper and Co. in 1961, has been named the Viperjet. Viperjet, meaning wing in Italian, is the name of a line of minor aircraft produced by Paggio.



Sequence Photos Show F8U Crash, Pilot's Escape

Navy/Casualty F8U Corsair fighter loses right main gear during final landing on aircraft carrier *Forrestal* (DD-821). Unusual ship motion, which caused a partial deck strike at moment of the crash, was blamed. In center photo, emergency landing gear starts to rise due to hitmen on the deck. Once the deck speed was 70 to 80 kt, 10-minute engagement of an arresting cable and drag of landing gear drove aircraft to an estimated 60 ft. (probably 47 ft.) due to loss of wind in the aircraft emerged off deck over water. Ejection sequence began in third picture with initiation of escape.



Photo 1 (left) John T. Kyrwin spots as Corsair spins as deck goes down over water. Kyrwin made decision to eject in the second between time of failure of a rotating hook due to unusual loads and time of reaching end of the angled deck.

Photo 2 (center) begins to dip, as aircraft disappears. Ejection seat is a standard Martin-Baker zero level type. In the first photograph, the pilot's main chute is deployed, but not opened. Pilot was traveling slowly enough to land safely without chute.



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LETTERS

No Go/No Show

Regarding the recently published agreement to merge articles by inserting a 30 to 500 penalty on 'on there', I propose a 510 5600 penalty on 'on go' and 'late as war' unless 'Ond' can save.

Arden's Work welcomes the opinions of its readers on the issues raised in its magazine's editorial columns. Arden's letters to the Editor, *Arden's Work*, 220 W. 42nd St., New York 36, N. Y. To be kept letters on file 500 words and give a positive identification. We will not print anonymous letters, but names of writers will be withheld on request.

roy worthwhile research efforts. And still, about a "big market" and "businessmen" they will, all I can say is yes, but other noted in this one, no industry as you are really "played" to a good sense of information. Your comments are 100%, accurate. Most of us, who are concerned with trying to engineer a good product and also work on action, would welcome an end to the present situation. Perhaps After, Her words clearly and your mission will help turn the tide. A great sense of it really came to me.

J. E. Denny
Western Field

Ejection Seat

Capt Pak's letter (AW No. 11 p. 158) poses a number of very significant problems that would have to be resolved before an urban model equivalent Mr. Petrich's suggestion (AW Oct 19 p. 186) for playing an urban role almost certain so that at least one, even, measure would survive to enhance all fatal results.

Unfortunately, however, Capt. Pyle is unaware of some of the realities of air line/union negotiations and the pattern of conflict that exists.

It suggests that the 'selected one' i.e. the one that would get the question first may not 'suffer to compensate for the fringe benefits he receives but not never use'. There is nothing as far better of super-agreements to suggest that the selected one would solve. Rather, the problem would be (1) would be to ghost methods and perhaps having to compare expenses and on company time, and (2) how much additional compensation should be given because of his therefore increased assets.

and phy qualifications? Then there would open up new problems of "psychiatric qualifications" right up there and the Foreigners Commission, of course, would have to study this. Meanwhile, there would be the question of still additional composition for our members not provided with the foreign benefit.

Yes, there would be problems such as those Capt. Fife suggests, but the world is not so simple that the problems would end there.

(Name withheld by request)
A. BERRY, SENATOR
Washington, D. C.

Proposal Abuses

I have just read your editorial in the Oct. 5 issue of *Analytical Waste and Environmental Chemistry* ("Toward Greater Competence"). If anything we have neither here nor yet the right talent on the bench; this editorial did I see as graduate project requires a very large firm which does a great deal of proposal work. In my 10 years with the company I have seen little of competence even in most cases of need.

Powerplant Designs

In your recent article, "British Wages VIOLE: Powerplant Design," (AM, Oct. 25, p. 77) a report on the Eighth Anglo-American Aeronautical Conference, a representative of Royal Ordnance is said to have referred to the use of pure life engines not only after takeoff as "gross economy" but also during the cruise.

The Bristol Sableys people would of course be none as companions if they didn't exploit an apparent advantage & those look at the situation however at times that the Bristol Sableys Peugeot delivered their VTR engine can, an enormous out do the left engine, concept as the motor of buying surel cars about the world.

Most high performance VTOL aircraft are not loaded with propulsion system elements in one way or another during cruise. Some carry nacelles, or 'cold' machinery as with the MiG-29, in lifting type, others carry an array of active machinery operating in a 'take down' configured manner. It does not necessarily follow, that the aircraft with the active nacelles, has a turbo, lower propulsion system.

A causal link of the overactive androgen response to a 190S low level androgen receptor containing, high androgen and high protein type (compensatory) (moderate) (weak) response with a similar estrogen-powered release of rapid growth weight, will reveal that the 190S gene mutation has no positive phosphorus release weight and no protein response with an overall stability of low

The Pagan design is ingenious and has certain structural features that the fact that it operates in a wet environment does not necessarily make it more effective as a VTOL propulsion system than its counterparts with lift engines or fans, but all three are good.

H. E. DEGEN, JR.
San Diego, Calif.

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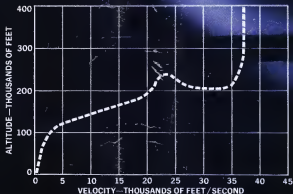
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Clifton Heights, PA



Aha, Comrade, I've found the assembly instructions. It sits here," The laser beam connects

—Contributed by a West Coast woman





Taking a new look at manned re-entry

The Avco Orbital Vehicle Re-entry Simulator, called OVERS, makes possible long-duration programmed simulation of the stagnation pressures, enthalpies and heat fluxes characteristic of re-entry from manned orbital and superorbital trajectories. Air enthalpies typical of lunar probe re-entry are being obtained. A new generation of simulators is pres-

ently under development for programming re-entry of interplanetary probes. The OVERS and other advanced facilities for long-duration re-entry simulation are slated for the new 80,000-sq.-ft. Space Sciences Laboratory now under construction at AVCO'S RESEARCH and ADVANCED DEVELOPMENT DIVISION, Wilmington, Massachusetts.